THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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GERMAN ELECTRICAL CONCESSIONS IN RUSSIA.

As we have suggested already in discussing the future electrical position in Russia, a great deal may depend upon the attitude that the Russian Government assumes in regard to the German-owned electrical concessions and undertakings that have been operating for some years to the financial benefit of Germany from an investment point of view, and to the commercial and engineering advantage of that Empire by providing orders for electrical machinery and apparatus.

A number of years ago British commercial engineers and financiers spent no end of money and time upon negotiations to secure for this country concessions of first-rate importance in Russia, but for various reasons they were not successful. In those days it was not for want of trying that we failed to secure both concessions and contracts for British firms. There can be little doubt that one of the most potent of the adverse influences that were at work was that exercised by German electro-financial concerns, and as the Russian Government pursues its inquiries into the position of particular undertakings, it becomes more and more obvious how effectively that influence was employed.

From what has lately appeared in our pages, it will have been observed that the Russian diplomatic world has been very much exercised respecting revelations that have been made, as the Government has, through the channels of a special Council, investigated the actual facts in regard to the character of the Petrograd Electric Lighting Co. of 1886, to which we referred last week. As we stated then, the Russian Government would hardly proceed with the liquidation of the company unless fully convinced of the almost entirely German nature of the undertaking. How much interest is being taken in the matter in Russia may be gathered from the fact that a copy of the *Novoie Vremya* recently received devotes four pages of one issue (*Daily Telegraph* size of page) to the matter. It seems that when the company was formed nearly thirty years ago it had a capital of only a million roubles, and it was established to carry out a concession granted to a German engineer by the then Minister of Finance. The company wanted its statutes based on German laws, but the said Minister desired it to operate according to Russian statutes. It seems not to have occurred to him that a German company operating with German money, through head offices in Berlin, was not a Russian concern, simply because for its Russian operations it rested on statutes more or less adapted to Russian law. As the concern prospered, its operations and capital rapidly grew until, in the spring of last year, the latter reached 40,000,000 roubles, and a fresh issue of 10,000,000 roubles was made in Berlin about that date, all of which reached the coffers of the Deutsche Bank, in accordance with orders given, two months before the war, by the Administration of the German Reichsbank, to detain foreign payments.

The concern acquired new markets in Russia, operating in Petrograd, Moscow, Pietrokoff and Lodz, while it also

extended its tentacles to embrace the utilisation of the famous Imatra Waterfalls of Finland. All of its endeavours appear to have been distinguished by that enterprise and confidence that came from its ability to count upon the powerful support of German diplomatic agents, and in this spirit, it appears from the *Novoie Vremya*, the managers of the company discarded the requirements of the Russian statutes and neglected the interests of Russian electricity users, with the result that there was frequent friction between the management of the company and the town authorities. The Moscow town councillors were particularly energetic, and in consequence relations became strained, and whenever it was sought by the Council to smooth matters over, these efforts were unsuccessful because the representatives of the Moscow branch were always able to say that they were without instructions from Berlin.

The situation eventually involved the intervention of the administrative powers, and in August, 1914, the Governor of Moscow appointed a special committee to examine the accounts and position of the said company and to maintain a watch over all its doings. This Committee submitted a comprehensive report to the Governor throwing light on the previously unobserved activity of German contractors in general, and of the 1886 company in particular. It was found that the Moscow administration and the Petrograd board were, right down to the war, in direct communication with the 1886 Electric Lighting Company in Berlin (Gesellschaft für Elektrische Beleuchtung vom Jahre 1886, Berlin), to which they applied for instructions.

It was also decided that the Berlin company should control the construction of the new house of the Russian 1886 company, in Moscow, for which purpose a German architect was sent to superintend the construction of the house, and, subsequently, the Berlin control extended to such small matters as the engagement of employés of the company. Financially, the report shows that the Deutsche Bank of Berlin was at the head of the concern, and kept the funds of the company; further, when the question arose of the issue of fresh capital, a consortium of German banks was convoked in Berlin, at which all details of the issue were settled. The Committee supposes that all the 10,000,000 roubles resulting from the issue made in the spring of 1914 remained in the Deutsche Bank, in current account. A shortage of cash occurring, the Moscow branch applied at the beginning of July to the Petrograd house for money to pay its accounts; but it was informed that this could not be done, as the money that should have reached them out of the last operation was in the Deutsche Bank, Berlin, and that prudence should be observed in respect of expenditure.

As to the nationality of the shareholders there can be no doubt that most of the shares are in German hands, and only an insignificant number in Russian hands. Some of the nominally Russian shareholders are actually German, and, in actual fact, Russian shareholders own about 100,000 roubles value only—that is, about one-third per cent. of the total capital.

All the foregoing leads to the conclusion that the 1886 company is practically only in name a Russian company; both financially and administratively it is a German concern, and it is considered that the systematic evasion of any examination of the state of things in the Moscow branch, thanks to the special system of book-keeping, inspires no confidence that its further operations will not be prejudicial to Russia; and that therefore the 1886 company should be pronounced inimical to Russian Imperial interests and should be liquidated.

On the foregoing grounds the Government has been petitioned by the Town Council to arrest the activity of the company, but according to the Russian paper referred to, though the nature of the company has been fully exposed, and the members of the Government and the Town Council have unanimously agreed on the need for the earliest possible liquidation, there is no evidence of steps having been taken to carry the decision into effect.

British electrical firms are entertaining great hopes regarding the future of electrical engineering in Russia, and in view of that fact it is of interest to know as much as possible regarding the actual character of the past German operations there, which had given them so strong a hold on the market, and also to observe the official attitude toward German-owned concerns, and to see whether, even now that the above report has been made, the liquidation recommendations will be actually carried into effect. It is hardly conceivable that the Russian powers in authority were in deep ignorance of the German character of the company, though they may not have known to what an extent the best interests of Russia were subordinated to those of the Germans concerned in the matter. No doubt the Russian authorities will see fit to assume control of the company, and include the matter when terms of settlement are under consideration at the end of the war. It may be that Belgian, French and British parties will then have a better opportunity than they have hitherto had in connection with the exploitation and conduct of electrical concerns in Russia.

Meanwhile, however, it is significant, as stated in our "War Items" to-day, that transfers of German-owned electrical undertakings in Russia are already being conducted in Belgium. It is reasonable to anticipate that such transactions will not be recognised by the Russian Government.

Copper.

THE upward movement in the copper market seems to know no end, the rise sustained during the recent two or three weeks exceeding £10 a ton, while the indications seem to suggest the strong probability of a further advance in the near future. Far from showing any signs of a reaction, the tone remains as firm as ever, and producers in North America appear confident that the market will abate none of its firmness for a long time to come. It is abundantly clear that all estimates which were formed last Autumn as to the probable effect of the war upon the metal markets were based upon a serious misconception, and the tendency at the present time is to look for a further advance in values in all directions. Certainly production has fallen below the necessities of the buying which has been going on, and it must not be forgotten that a considerable proportion of the copper utilised in ammunition does not usually come back in the form of old material at a later date.

The prime consideration dominating the market at the present time is, of course, the large outlet which exists in connection with war requirements, and there should be a considerable increase before long in the production of refined copper available for this purpose. There seems to be no limit to the capacity of consumption, however, and there can be not the least doubt that the stocks of refined material awaiting disposal have been very much reduced during the last few months. It is only a few weeks ago that prominent American copper interests were booming the wisdom of the policy of small output and big price, but they seem to have been swept off their feet rather by the remarkable broadening in demands, and the tendency in all directions now involves a distinct increase in production. Very large quantities have been booked for export in the the United States within the last month or so, and the European demands show not the least signs of being reduced. Prices are reaching a very high level, and there has been a good deal of speculation initiated, but for all this the foundations of the market appear to be quite sound. The last few days have witnessed a good deal of new buying, both of refined copper and of warrants, and while the speculative element is not liked, the fact cannot be concealed that part of it comes from influential American quarters—the significance of which it would be foolish to disregard.

There has not been much passing in the general consuming trades, for all the plant available is running on Government work. American opinion inclines strongly in favour of record prices being attained, the opinion being based not only on the consumption for war purposes both in America and Europe, but also upon the fact that the home trade demands in the United States have lately begun to improve considerably, and there can be little doubt that if domestic consumption across the Atlantic reverted to anything like the average of the best months of last year, prices would receive a further sharp fillip.

THE ENGINEERING INDUSTRY AND THE WAR.

The reassembling of Parliament has been followed by the inevitable opening of the floodgates of oratory. When the Houses were not in session we dared to hope that we should soon have some measure of relief from rumours that were so prevalent and persistent in certain circles. What the Censor, and the War Office behind that authority, did not see fit to divulge, might perchance escape the lips of some speaker in the Lords or Commons in some unguarded moment. The newspapers which are continuing to show irritation at having to suppress so much information that reaches them, are "again the Government" whenever they are able to detect an opportunity for criticism, and they have found occasion to exercise their privilege in connection with statements made by different Ministers on the subject of the output of munitions of war. Now the majority of us have had quite enough of oratory for the present—we want to attend to the very important business that we and our Allies have on hand. And unless our Parliamentarians can show tolerable agreement in their policy and attitude toward things that are of vital moment, it were better that they should cross to Flanders and leave the "business" to men of "few words." Of critics and advisers all Governments that have attempted anything have had their share, and so many new problems have arisen during this European war period that the number could hardly be expected to decrease. The list of Special Committees that have been appointed from outside as the months have passed by, and the conferences that have taken place between members of the Government and authorities in financial and other walks of life, have shown the willingness of the Government to take advantage of the expert knowledge that has been lacking in its own immediate political circle. But we are bound to say that, if there have been too many critics, those who cast the blame therefor upon the Government—whoever that may mean—for keeping us in the dark, have our sympathy. It is not well in days such as these, when the issues involved are so enormous, that the people should have any want of confidence in those at the helm, and we profoundly trust that circumstances will speedily remove the grounds for grievance. To that end let us have no more speaking than is really essential, providing opportunities for untimely quibbling or for efforts to make the statements of those who are working together to find ways and means for bringing this gigantic struggle to a successful issue, appear to be irreconcilable. We are reminded that Carlyle (in the "Latter Day Pamphlets") asked his readers to consider a body of 658 miscellaneous persons set to consult about "business" with 27 millions, mostly fools, assiduously listening to them and checking and criticising them. "Was there ever since the world began—will there ever be till the world end—any 'business' accomplished in these circumstances? The beginning of all business everywhere, as all practical persons testify, is decidedly this: That every man shut his mouth and do not open it again till his thinking and contriving faculty have elaborated something worth articulating . . . . . This is the preliminary fundamental rule for business."

We were told a short time ago on very excellent authority that "shells—more shells!" were what we must have. Instead of every man who, by any stretch of the imagination, had anything whatsoever, direct or indirect, to do with the production of these, proceeding to increase his individual output, we found ourselves involved in discussions which certainly did not immediately assist matters. We revived all the old controversy about drink. Every manufacturer, we suppose, knew well enough, by more or less lengthy experience, that drink was a handicap both to worker and to employer in normal times. But it was the fact that the workers had many thousands of their own brothers and sons fighting in the trenches, and if they had been allowed to know the truth there would probably have been strong influences at work among themselves to reduce drinking. We have never thought in normal times that the British workman would submit to his individual liberty being interfered with in this connection, any more than we have regarded him as willing to listen to reason concerning industrial quarrels, because his personal interests have always been paramount for him. But we have never lived in times like these before—may we never do so again!—and abnormal times call not only for exceptional measures from the nation, but for abnormal effort on the part of each individual having even a remote part in fighting the most abominable foe of recent centuries. The reports regarding the effect of drinking upon output have varied very considerably. One deputation to Mr. Lloyd George showed that the weakness occasioned employers extreme concern. Other authorities say that they have had no adverse experience from drinking. Some say that better wages have enabled men to work only four days a week, and, self-satisfied, they have delayed the operations of others by absenting themselves the rest. Some of the works owners have complained that if men will insist on having their Saturday half-holiday (which we think they surely should dispense with now that they know the facts of the situation) their machinery lies idle when it might be operating. Some authorities have affirmed that long hours and continuous work wear men out if they have no Sunday rest, so that they become more susceptible to the drinking and Saint Monday habit. And so, by these and many other expressions of opinion, have we been brought into a state of chaotic thought regarding a social problem, and a big economic one, too, that has exercised ministries, Parliaments, social reformers, and, indeed, all of us more or less, for many decades. It will be a thousand pities if we spend our energies in time of war trying to find a quick solution for what the years have proved to be one of the most complex and involved of all our national problems. We are confident in the assurance that powers are already in existence for dealing with the matter in time of emergency, and we believe that the firm hand of Lord Kitchener may be relied upon for dealing in an appropriate manner with the men who are traitors to their country and to their brothers on active service. We see difficulty in the way of a Government, which has given us the term: "not drunk in a police court sense," dealing with men who go back to work incompetent or inefficient because of fuzziness, but the Minister for War may exercise means that Cabinets view in other times with disfavour, yet which in time of emergency would have the moral support of practically the entire nation.

We are living in very heart-searching times, and we hope that this process of self-examination which the recruiting poster, the recruiting sergeant, the drum-beat of the highway, the message from the trenches, all induce, will bear fruit in the increased production of munitions as well as in the enlisting of fit men. The recruiting poster, the drum-beat of industry, and the call for "Shells! More Shells!!" might do much to influence the mind of the industrial worker, and lead, in conjunction with suitably restricted hours for public houses, to a greater moral force being brought into the factory fight, a fight within the man himself in order that he may do his best. "Be no longer a Chaos . . . Produce! Produce! Were it but the pitifullest infinitesimal fraction of a product, produce it, in God's name. 'Tis the utmost thou hast in thee: out with it, then. Up, up! Whatsoever thy hand findeth to do, do it with thy whole

might." Words of Carlyle these—in the "Everlasting Yea!" chapter of the *Sartor Resartus*. Written in another connection it is true, but how fitted to the present emergency—they would almost do for an Industry Recruiting Poster! They are, of course, not in keeping with the tenets of Trade Unionism as we have all known it. Limitation of output!—part of the gospel of Trade Unionism—how does that sound in these days of war? It has done its work—nobody can deny the character undermining effects of that damnable teaching. The British workman *at his best* is a fine fellow, and he can beat his class in other industrial nations, but you cannot have a work-limiting, suspicious, grudging policy or tendency controlling or influencing men for years without it leaving its after effects. Now is the time for the British workman to patriotically assist the land of his birth in her hour of trial by shaking himself as free as he can of those limitation shackles. Would that he would abandon them once and for all, and always do his utmost, then we should have little cause to fear the ruthless competition of the enemy in trade and manufacturing. At any rate, let us have freedom from these abominable self-imposed restrictive handcuffs when British blood is flowing out in Flanders. We are glad to learn from one of the daily papers that "an agreement has been come to between the Federation of Engineering Employers and the Amalgamated Society of Engineers for temporarily relaxing such trade union rules as tend to restrict output." Unquestionably trade unionism, like every other part of our national life, is passing through its trial, and though it may seem premature to utter it, we will indulge a hope that it may, in respect of this output restriction question and some other matters, come through the fire refined, an altogether more creditable part of British national life, fostering the growth of a co-operation between employer and employé in manufacturing competitively and successfully for the good of all, so that Britain may have its full share of trade despite all comers.

The direction in which this output limitation has been leading has been witnessed at times in recent years in the intention which some workmen have expressed, without a trace of shamefacedness, to adopt a definite policy of doing as little as they can. An ingenious alternative to striking this—they would go in and take their money and simply do as little as they possibly could. To what depths of moral depravity we threaten to fall if this policy of common dishonesty be permitted—we cannot conceive of its being actually countenanced—by Trade Union organisations. We suppose that it would be considered impolitic to pursue this very distasteful subject at the present time, but it is useless shutting one's eyes to the facts, and, in our own opinion, if there has been shortcoming on the part of workers in producing manufactures, it has been in the case of a number of them the inevitable consequence of this output limitation policy, and its still more reprehensible offspring—the will to adopt deliberate slacking instead of striking. The strike habit, which for years past has been gaining a tighter hold upon industrial workers, has lately shown itself at its very worst. These men know what is right or wrong at a boxing match—would they not with one voice swear one unanimous oath if either were hit when he was down? Have they not shouted "Foul!" at football? Is there not honour even among thieves? Yet when their brothers are engaged in deadly struggle, when the land of their birth is fighting for its very existence—they are willing to assist the most rapacious and dishonourable foe that ever planted iron-heel in European soil? Cartoons are more forceful than oratory or written words, and they have played a fine part in recent events. They might be used to get the truth and very necessary arguments into the heads of all who are "producing" munitions to-day. In one very effective cartoon a British khaki-clad hero, back from the front, is pictured in conversation with a discontented striking workman. "What would you have said of us in the trenches if we had struck for better pay?—but that's what you've been doing!" We are all of us having to carry sacrifices to-day—shall we justify Carlyle's description and strike? The British workman, when he complains of the cost of living, knows well enough that his services are so necessary that he can work overtime, and seven days a week, if he will, and get a bulging purse which will more than pay the increased cost and leave him something over for any bad days that may follow later.

We indeed hope, now that a little light has been poured upon the situation, and the pressing necessities are becoming better appreciated, that the men will everywhere trample down their own weaknesses—drink, strike, ca' canny and dishonesty—and "deliver the goods," carrying into immediate practice the "Aye!" which, at Mr. Asquith's meeting on Tyneside, thundered out their resolution to do their best.

But not drink and labour disaffection alone are responsible for any apparent failure to "deliver the goods" as quickly as they were required. That it was not dreamt that ammunition would be used at such a rate as, for instance, at Neuve Chapelle, is a factor that it would be uncharitable to overlook. It is easy to criticise the powers in authority for what they have not done, and that we may leave to others or to a more appropriate occasion. Sufficient to say that actual requirements for the armies in the field have exceeded everybody's calculations. The figures given by Mr. Lloyd George go to show that we have increased our rate of output at a greater rate than any of us had reason to suppose, but still the mobilisation of our industries is necessary in order that we may keep ourselves and our Allies supplied, and strong men and representative committees have been appointed to see that the thing is done. Not only have the industries to be mobilised, but the workers have to be found to keep every available piece of productive machinery employed.

When the call to the Colours was issued, from the ranks of the skilled engineering workers, and the miners, men left their places by hundreds of thousands—it was not foreseen that for what has proved to be an engineers' war, all our engineering labour would be required. It is stated that recruiting for the Army took 30,000 men from the Tyneside engineering district, and the question of bringing back from camp and from the Front some of these whose services are essential in the factories, has been under discussion; indeed, we believe that some have already been called back. Our own pages have borne evidence to the large drafts that have been made on the employés of engineering firms and companies in Manchester and other industrial districts, and we can only suppose that if it had been possible to foresee the engineering nature of this war, and the extent to which dependence would be placed upon us for the supplies of our Allies, many of these would have been dissuaded from going. Yet the recruiting sergeant is still active round our engineering shops! We are informed that Lord Kitchener sets no limit whatever upon our requirements, and it was stated in Parliament last week that that man was serving the cause most patriotically who was producing to the utmost of his power. Then why continue to draw them off from already hard-pressed factories where this producing is in progress? This mobilisation of works and workers has occasioned no little anxiety among the owners of small factories, who are fearful lest their men and machinery may be commandeered for service in bigger factories where it is more convenient to manufacture what is needed. An appeal has been made to municipal authorities to release for factory service as many as possible of their

employés who are now engaged on things that, comparatively speaking, do not matter. When the great municipal strike at Leeds took place it was found that it was possible to dispense with certain classes of labour, and the appeal now made promises to lead to the release of thousands of men from other cities for productive operations in important manufacturing centres. These experiences may incidentally teach us some lessons regarding the more economical conduct of municipal affairs.

We believe that on the whole it has been shown that manufacturers are prepared to do their utmost to hasten the coming of victory by placing their resources at the disposal of the Government. We believe also that some of the difficulties due to want of organisation are rapidly disappearing, and if only the workers can be induced to "do their bit" with the same energy, zeal and self-sacrifice as characterise the conduct of our Forces in the Field, there will be little further cause for complaint. But it requires little special knowledge to observe that, in the present condition of affairs, many of our undertakings are too busily engaged upon Government needs to be able to make any important headway with efforts to "capture" our enemies' trade. Commercial and selling staffs which have an undesired measure of relief from their accustomed vocations are doubtless not neglecting that matter but are looking well ahead.

THE FIGHT IN THE FACTORY.

By "COMMERCIAL."

A noticeable feature of many of the recent annual meetings of manufacturing firms has been the oft-repeated statement that Government orders were on hand, such orders occupying the attention of a considerable part of the works' plant and labour. Usually these requisitions are in the general run of the products of the firm in question: in other cases —and these are not a few—men and machinery are being utilised to make certain articles or parts which are quite out of the beaten track. A motor-car works turns to special ordnance; an engine works to aeroplane parts; a locomotive works makes armoured trains; and so on. The man in the street may, or may not, be aware of all this business topsy-turvydom. He may meet people who have laboured seven days a week for months on end, making ships, guns, shells, cables or cartridges. He may have seen the inspecting officers of H.M. Government sleeping on the test bed of some engine works, where engines are being tested for this or that battleship. The cumulative effect of war upon work in the factory is, however, much greater and more complex than some people seem to imagine, and many new problems have arisen which are quite alien to the ordinary every-day perplexities of business. Of these, two are most important and most difficult of solution, the supply of labour and of material. Another which is, perhaps, only an aggravation of an old trouble rather than a new one, is the organisation of output in accordance with customers' requirements.

Readers of the Electrical Review were recently asked to bear in mind, when inquiring for delivery, that Government orders were obliged to have preference in the factories, and that patience should be exercised in a more than usual degree when manufacturers were tardy in delivery. This request was, as Euclid says, "self-evident, and required no proof." At the same time, for the information of some, it may be well to enlarge upon the three points already mentioned in this connection, to indicate generally the conditions under which factories are running to-day, and the troubles of the manufacturer. Naturally, these three items form the same difficulties for factories generally, the only modifications being that for different industries and localities, the most acute problem is not the same, but varies according to circumstances.

Labour was none too plentiful before August, 1914, and Government requirements (in the case of which the writer has experience) necessitated both extra plant and a partial double shift. Machine hands, unlike poets, are not born but made, and the required number had to be trained in as short a time as might be. The arrival of new machinery and its installation saw the establishment of a night shift, with the inevitable division of the available men. This was only done at the expense of a stoppage of other machinery for periods of a few days, and no little ingenuity was wanted to make things fit. Eligible workers enlisted or were called up to join their Reserve or Territorial units, and older workers were absorbed from industries upon which the war has fallen as a blight. The old business adage of modern rush, "too old at forty," has gone by the board. The age limit for engaging workers, if it has not vanished in toto, is at least twice the figure of pre-war days, employers' liability and other obstacles notwithstanding. The gaps in the ranks of men have so far as practicable been filled up by girls. A forty-eight hour week has, for the bulk of the machinery, mysteriously expanded into about two-and-a-half times its normal term. The works staff remains as before: yet the amount of supervision is more than doubled. The percentage of sick has increased, and the cause is not drink. Long hours and night work have claimed their toll in the works "casualty" list. The new order of things is now on trial, and time will show its efficiency. So far as labour is concerned, the emergency has been met and tackled, as engineers say, with a fair measure of success. The maximum output, if not now achieved, should be only a matter of a short time. Whether the new machinery will always be running 21½ hours per day is another matter, depending upon a rather large number of problematical "ifs." That is our risk.

The supply of raw material has been, and still is, an undertaking of somewhat precarious nature, as uncertain as the weather. One firm's raw material is another firm's finished article. Concurrently with the sudden jump in the demand there has come in some materials a serious check in the continuity of supply, and sometimes even in the quantity there has been a deficit. Copper and lead are obtainable in spasms, and the arrival of these metals again depends upon another series of "ifs." Among these are: if the ship were not commandeered by the War Office or Admiralty *en route;* if it were not torpedoed by the enemy; if it could be unloaded when docked. Actually, one boat was so commandeered, and ran about the world with copper in her hold until she was released and able to come home and unload her cargo. Another was dry-docked with copper aboard which could not be unloaded owing to dock-labour trouble. Other goods were only to be bought in comparatively small quantities, and for delivery at such dates as would only allow a hand-to-mouth sort of existence in the shops where they are used. Matters have certainly improved of late, and suppliers are working strenuously to cope with the abnormal demand, but even now assurance is lacking that one material or another will not suddenly run dry, and temporarily put out of commission this or that department. Further, when one must earmark, for Government orders only, the whole supplies of a particular commodity or some special size or class of raw material, it is not easy to see where the ordinary customer comes in. This has been done in certain sections of electrical engineering, and is still being done. Then the question of the apportioning of the output becomes a little more clear. The old story of the three essentials to success: First, audacity; second, audacity; and third, audacity; is adapted to

war requirements, and it is "war urgency" every time. The other people are the regular old-standing customers, and new-comers, some of whom (whisper it) have always previously bought from Germany. There should be no doubt as to which of these obtains priority after His Majesty's orders are filled. The sum total, however, amounts to a deal of work, and even with overtime and double shifts it is not easy to arrange for anything even approaching strict rotation of manufacture. Especially is this the case with small orders and stock lines, which, in the ordinary course of events, are turned out promptly. Stocks run out, and in the general pressure are quite a time in their renewal. An extra quantity of sweet reasonableness is therefore needed on the part of buyers who cannot get their stuff delivered. Things are bad no doubt, but the shop is open on this side of the English Channel, but what of the other side? There are many who do not complain overmuch, and there are the others. One gentleman writes: "Work overtime if necessary," as though to offer us the "open sesame" for a quick dispatch of his requirements. Another says: "This order was placed on a rush basis"; he apparently forgets that there are others on the same basis for the battlefield or the submarine. However, these small touches add to the gaiety of nations. Other orders come in with a penalty clause attached, and some of these from our Colonial Governments. One wonders what would happen if one of these penalty lots were torpedoed on its way to the Antipodes. To penalise manufacturers in peace-time is justifiable, but the war has lasted long enough for the penalty clause to have been jettisoned long before now, and it is questionable whether a penalty could be enforced at present, even though the order had been booked during the term of the war.

From this bald statement of the case one may, to some extent, appreciate the accumulation of troubles under which factories have been working for the past few months. Orders can be dealt with subject to the conditions indicated and to the limitations involved. Nobody can pretend to anticipate the extent of Government requirements or the time of Government demands. It is on this account nearly impossible to promise with any degree of accuracy the time required to execute other orders, and bearing this in mind one will doubtless lend the toleration asked for in the Review article to which reference has already been made.

GOOD LIGHTING AND ITS EFFECTS.

By V. H. MACKINNEY.

(*Abstract of paper read before the* Yorkshire Local Section of the Institution of Electrical Engineers *at Bradford, April 14th*, 1915.)

It is somewhat singular, seeing that so much care is devoted to the natural lighting of buildings, that the provision of artificial light does not receive more care. Not infrequently when buildings are erected the artificial lighting is left to the very last, and the amount expended on it is quite out of proportion to its importance. Yet in the present age artificial light plays an important part. Much of the labour of to-day is done by artificial light; most people find in the evenings their main opportunity for social enjoyment and recreation. During recent years educational authorities have been making special efforts to better the lighting of schools.

Bad lighting, by adding to the strain of labour, causes fatigue and general deterioration in health, even when it does not directly affect the eyes; it is also directly responsible for a large number of accidents. Accidents are always a source of loss, not only because of the compensation paid to the injured, but also because of the disorganisation to which they give rise. It has been proved that unsatisfactory lighting is often a cause of spoiled work, and that it slows down the speed of operators and limits the output. In a certain factory tests were recently made before and after an improvement in the lighting, and it was found that the output had been increased by 11 per cent. The cost of lighting is almost always a minute fraction of the wages bill—in many industries less than 1 per cent.—so that even a small increase in output would more than repay the relatively small cost of putting the lighting on a satisfactory basis. The finer the quality of the work, and the more skilled the operator, the more serious are the results of poor illumination. In the textile factories of the North the weavers migrate to those mills that are known to be well lighted, and desert those where the illumination is notoriously bad; they know that they can earn more when the illumination is satisfactory. A clerk working in insufficient light is apt to make mistakes, and no one can foresee how serious the consequences of such a slip may be. Show-window lighting has become a fine art, and up-to-date merchants fully recognise the value of well-lighted windows as an advertisement.

It is not such an easy matter to say exactly of what good lighting consists; only long experience can show exactly how much light is needed for different classes of work, and only the skill of the trained lighting expert can secure that in any installation this correct amount will be provided. Another fundamental rule is that the light should be directed where it is needed. Proper shading is one of the first requisites in successful illumination. The reflection of surroundings plays an important part in the resultant illumination, and it is quite possible to obtain an increase of as much as 80 per cent. over the calculated values due to reflection from the walls and ceiling, if the room is within reasonable size and the surroundings are light in character. The following table indicates the amount of assistance one may expect from different surroundings:—

Condition of ceiling.	Condition of walls.	Increase over calculated illumination.
Very dark	Very dark	0 %
Medium	Very dark	15 %
Medium	Medium	40 %
Very light	Very dark	30 %
Very light	Medium	55 %
Very light	Very light	80 %

The following average foot-candle intensities are recommended for the various classes of service indicated:—

Art gallery (walls)	5·0	Museum	3·0
Automobile showroom	6·0	Office (general)	4·0
Bank (general)	2·0	Power house	2·0
Bath (public)—		Railway carriage	2·0
Dressing rooms	1·0	Reading (ordinary print)	4·0
Swimming bath	2·0	Reading (fine print)	6·0
Billiard room (general)	1·0	Residences—	
Billiard table	15·0	Porch	0·5
Courts—		Hall (entrance)	1·0
Squash	6·0	Drawing room	1·5
Tennis	6·0	Sitting room	1·5
Church	3·0	Dining room (general)	0·5
Desk	4·0	(Local on table)	4·0
Drawing office	8·0	Kitchen	2·0
Drill hall	3·0	Bedroom (general)	1·0
Engraving	10·0	Dressing table	4·0
Factory—		Restaurant	3·0
General illumination only where additional special illumination of each machine or bench is provided	1·5	Rink (skating)	3·0
		School—	
		Class-room	3·0
Local bench illumination	4·0	Corridor	0·5
Complete (no local illumination)	4·0	Sewing	6·0
		Shop window—	
Garage	2·0	Light goods	8·0
Gymnasium	2·5	Medium goods	16·0
Hospital—		Dark goods	20·0
Corridors	0·5	Shops (interior)—	
Wards (with no local illumination supplied)	1·5	Light goods	5·0
		Dark goods	10·0
Wards (with local illumination supplied)	0·5	Station (railway)	2·0
		Street—	
Operating table	12·0	Business (not including light from shop windows, &c.)	0·5
Laundry	1·0		
Ironing table	4·0	Residence	0·1
Library—		Country roads	0·05
Stock room	1·5	Studio	4·0
Reading room (with no local illumination)	4·0	Theatre—	
		Lobby	3·0
Reading room (with local illumination)	1·0	Auditorium	2·0
		Train shed	1·0
Market	3·0	Type-setting	8·0
Moving-picture theatre	2·0	Warehouse	1·5
		Wharf	1·0

The minimum illumination at any point should not be less than half the values stated above. To calculate the foot-candle illumination one must have full particulars as to the polar distribution of the light source he is going to use, also the actual candle-power emitted by the source in the different zones. With the advent of different forms of filament winding and different efficiencies of lamps, the present rating is becoming insufficient. The most ideal method seems to be the rating of lamps in quantity of light emitted, *i.e.*, lumens—a lumen being equal to 0·0796 spherical candles; but the most understandable rating would be in mean spherical candle-power. The mean spherical candle-power may then be considered as a measure of the total flux of light, M.S.C.P. × 4 = total lumens emitted, and thus one source would be directly comparable with another. The source rarely gives exactly

the distribution of light required for a specific problem, and it is almost always necessary to use it with a suitable reflector. [The lecturer showed polar curves which indicated how the bare lamp distribution could be altered, and how great were the advantages to be derived by using a suitable reflector.] With white glass one can only obtain a general distribution; with mirrored reflectors only concentrated distribution, and with prismatic reflectors, properly designed, any distribution from extremely concentrating to extensive can be obtained. With enclosing glassware one has a very similar set of conditions. A frosted globe, which has only diffracting properties, leaves the distribution curve of the illuminant essentially unchanged, and merely smoothes it out by averaging the light flux over a narrow range of angles. An opal or white glass globe, which is an excellent diffuser, entirely changes the distribution curve by substituting the diffusing globe as secondary radiator, and retains only for a small portion of the light the original distribution. A lamp in an opal globe, not too dense, is, therefore, clearly but faintly visible, surrounded by a brightly luminous globe. In the case of a frosted globe the lamp appears as a bright ball of light, while its outline is not visible; the globe being non-luminous or but faintly luminous. With prismatic globes it is possible to obtain both good diffusion and redirection of the light rays. Clear glass with correctly designed prisms affords a means of controlling light to the greatest extent and redirecting it more efficiently than any other known material.

[The lecturer then showed a curve obtained from an enclosed prismatic unit in conjunction with a 400-c.p. half-watt lamp.] The unit is specially designed for street lighting and gives the maximum illumination—two and a-half times the rated candle-power of the lamp—at an angle of 15° from the horizontal, which is considered ideal for the purpose. The particular unit from which the curve was obtained is made up of two pieces of prismatic glassware, one fixed inside the other. The internal piece has a smooth interior and horizontal prisms on the exterior, and the external piece has a smooth exterior and vertical ribbings on the interior. This, when fixed together, offers both a smooth interior and exterior, which does away with the objection as a dirt collector of prismatic glassware when used in the open.

The following simple rules for good lighting should be observed:—Don't work in a flickering light; don't expose the eyes to unshaded lights in the direct range of vision; don't judge illumination by the brightness of the lamps; avoid excessive contrasts; use the right type of globe, shade or reflector; make sure that the illumination is sufficient; keep lamps, globes and reflectors clean; and make sure that the lamps are in the right positions.

Discussion.

Mr. Wilson Hartnell said that in a theatre or ballroom overhead lighting was required, in order that people could see what was going on around them, whereas in dining-rooms and drawing offices persons did not want to look around them, but desired to have the light directed on to what they were doing. In a drawing-room also subdued light was very pleasant, especially if persons met simply for conversational purposes. They should always ask themselves when putting in a lighting installation: "What result do you wish to obtain?" and then act accordingly.

Mr. Brown said that several times he had tried to demonstrate to people that Holophane shades were the best for their purposes, but the cost of the shades killed any arguments that could be put forward in their favour. When they came to put the thing into actual practice it was not quite so easy as it appeared on paper or on a diagram—a great many of the apparent advantages would have to be discounted when one was trying to convert people in regard to lighting.

Mr. Moss said he had had similar experience to Mr. Brown. He had gone to considerable expense and trouble at times in demonstrating Holophane lighting in mills as compared with lighting by ordinary shades, and he had always run up against the one difficulty—cost. At the same time, he thought it was quite possible to get very satisfactory results with a good glass or white opal shade. Shops to-day had to be attractive, and there was no doubt that lighting was one of the principal things a shopkeeper had to consider.

Prof. G. F. Charnock said his experience of lighting in the drawing office or classroom was in favour of indirect lighting. He had laid down a sort of standard some time ago, that from the lighting in a drawing office one should be able to read one-hundredth of an inch on a steel rule. Unless the light was very good indeed he did not think many would be able to do that, but he found with indirect lighting that it was perfectly easy, although when they entered the room they would not be impressed with the abundance of light. Well diffused lighting was wanted in a drawing office. If they used the desk-light standards they ran the risk of injuring the eyes, because one occasionally found it necessary to turn round for some reason or other, and the very great change from the bright light to the dark corners of the room was likely to prove objectionable. With regard to Holophane shades, if properly arranged they were well worth the extra cost. With some modern theories with regard to lighting buildings there was a tendency to run in the direction of too great economy, and rooms of buildings, halls and churches which were reputedly well lighted according to modern notions were, when one came to examine them closely, somewhat disappointing. If a man could not read his hymn book in church the lighting was not sufficient, and all the very beautiful effects on the ceiling and on the arches, and on the carving, and so on, were really of secondary importance. He would like to caution those present against taking too much notice of photographs, because, as an amateur photographer, he could assure them that with a little trickery in exposure and development they could get any result they desired. He did not regard the photographs which the lecturer had shown as satisfactory proof in regard to the installations concerned, and he thought it well to throw out a word of caution.

Mr. Wright said the lecturer had told them nothing about overlighting. He knew an arcade—lighted by gas he believed—into which it was positively injurious to the eyes for a person to enter. Proper shading ought to be adopted to diffuse the lighting. He agreed with Prof. Charnock with regard to the lighting of drawing offices. He was sure that his eyesight had suffered in his drawing-office days through the necessity of using a strong and concentrated light.

Mr. Collinson said that the diagrams which they had seen with regard to the metal-filament lamps largely went to show that the present shape of lamp was not altogether satisfactory, and it would rather appear that in the next year or two that type of lamp would be gradually eliminated, and another lamp put on the market which would give a better downward distribution of light. He understood the lecturer to hold the opinion that prismatic glass was the thing to use in connection with electric lighting. His own experience of prismatic glass was that when it was new and clean it was very good, but after it had been installed for a while and was covered with dust it seemed to lose a good deal of its efficiency. Dirty shades were ineffective, and although they could put on a good shade, unless they kept it clean they would not get the effects they should have.

The Chairman (Mr. T. Roles) said that personally he thought for dwelling houses shades of alabaster or special glass were much more pleasing in appearance than Holophane shades, whereas for business premises Holophane shades were, as a rule, found to be excellent. He agreed with Prof. Charnock with regard to the injurious effect of strong light on the eyes of draughtsmen, clerks and others who worked at desks, and thought that in every room it was necessary that there should be a scheme of general illumination so that one would not look from the strong light to practically no light at all. In the Bradford Town Hall it had been suggested, and, he believed, carried out in the majority of the offices, that the lighting should be immediately over the desks. In the electricity offices, however, he strongly opposed this form of illumination, and the draughtsmen and clerks supported him—they much preferred a diffused light which was practically shadowless. In regard to street lighting, and indeed, lighting generally, he believed it would take a number of years before they could convince the public that good lighting lay in good distribution rather than in having great flares of light in different parts.

The lecturer briefly replied to the points raised in the discussion.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electrically-Operated Carriage-Drive Gates.

The ornamental value of handsome gates at the entrance to a carriage drive is often lost upon those who have occasion to pass through them, owing to the necessity for descending from the vehicle to open or close the gates in the absence of the lodge-keeper. The electrical way of surmounting this difficulty is exemplified at a country house in the North of England, where a fine pair of gates, with imposing pillar supports gracing the approach to the hall, is electrically operated. The operating gear consists of a ½-H.P. Witton motor, geared through a clutch to a mechanism for opening and closing the gates. The electric motor and mechanism are housed in a small tunnel underneath the gates, a small manhole situated on one side giving access to them. Power is supplied from the house installation. The controlling switch, which is located in the garage, is of the reversing type, so that putting the switch in one position closes the gates, and putting it in another position opens them. On completing the circuit the motor is started up, and a solenoid circuit energised, connecting the motor to the gate-opening mechanism through the clutch. The presence of this clutch, which is open when the motor is not at work, enables the gates to be opened or closed by hand when desired. Before leaving the garage the chauffeur opens the gates, and after driving through, he signals by means of the horn to anyone who happens to be in the garage, should he desire the gates to be closed immediately. On the other hand, when the gates are found closed on the return journey the sound of the horn gives the signal for the switch to be put to the opening position. It is estimated that the gates can be opened over 500 times at a cost of 1d. for energy. The scheme could be arranged so that by means of a time switch the gates were closed some few minutes after the departure of the car from the garage; moreover, they could be controlled by means of a push button in the hall of the house, or by a mechanism completing the electrical circuit due to the weight of the car pressing on it as the car reached the gates.

The gates were constructed by Messrs. Lockerbie & Wilkinson, Tipton, Staffs., and the operating mechanism by the Witton-Kramer Electric Tool and Hoist Co., Witton, Birmingham, for whom the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., are the sole selling agents.

Electrically-Driven Cloth Printing Machine.

An interesting example of the electric drive as applied to the printing industry is shown in the accompanying illustration. The machine is a six-colour cloth printing machine arranged to print squares or rectangles, with side and cross borders in any length from 1 yard to 10 yards, increasing by 1 in., and using rollers 18 in. in circumference. The machine is driven by a 25 H.P. three-phase Witton motor, the controller resistance being mounted on the bedplate of the machine. As will be observed, the motor is completely out of the way, and the illustration gives a good idea of the compactness of the electric drive. The electrical equipment was supplied by the General Electric Co., Ltd., of Witton, Birmingham, and 67, Queen Victoria Street, London, E.C.

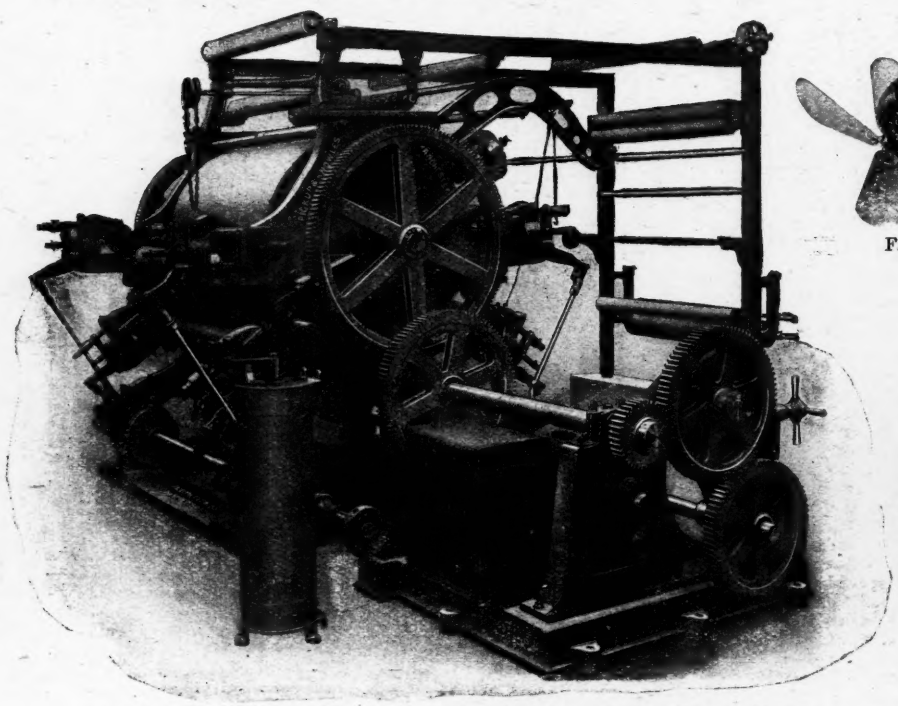

Fig. 1.—Six colour Cloth Printing Machine Driven by a Witton Motor.

The Naylorgraph.

Last week a demonstration was held in London of a new type of electric sign, known as the "Naylorgraph," which is being constructed by Messrs. Naylorgraph, Ltd., of 240, High Holborn, London, under patents granted to Mr. J. P. Naylor.

This sign differs from the numerous types of signs displaying words and set phrases, with which our readers are familiar, in that within its letter capacity it can be made to display any desired message, practically on the spur of the moment; moreover, its construction is such that the legend is visible by day or night.

The High Holborn sign, fig. 4, which is situated in a position commanding a considerable length of this thoroughfare, has an area of 400 sq. ft., measuring 33 ft. long by 12 ft. high; it consists of 52 monograms in four lines of 13; each monogram has 23 elements or units which can be grouped to form a letter.

The elements are of special design, consisting of a white disk-like member provided with two black metallic covers or eyelids, which are rotated by electro-magnetic means to uncover the disk; behind each disk is a lamp for night illumination, also controlled in a similar manner. The 1,196 elements comprising the sign are coupled up to a single keyboard, which is selectively placed in relation with each monogram so as to cause the display of any letter upon any panel, an auxiliary board being provided to delete or cause non-display of any desired monogram. This keyboard was primarily designed for the display of news, and by its means an average of one change a minute can be obtained on the sign.

The control devices are connected and operated in series, so that they can be connected directly to a 200-volt D.C. supply. It may be pointed out that the elements are self-contained units provided with a short flexible and plug, which are easily replaceable.

The sign was utilised for recruiting purposes during the week, with considerable success, and its versatility undoubtedly formed an attractive feature.

Messrs. Naylorgraph have been granted patents in over thirty countries, and their letter design and monogram are registered; we understand that they are prepared to negotiate for the exploitation of their foreign patents.

B.T.H. Electric Fans.

A recent list (No. 7,100-B) issued by the British Thomson-Houston Co., Ltd., of Rugby, gives particulars of a number of types of electric fans and fan motors made by the firm. Particular stress is laid on the desk and bracket types of fan, which are built for either direct or alternating-current working, with 12-in. or 16-in. diameter fans, and are built in oscillating and non-oscillating designs, both having swivel and trunnion mounting, which permits the movement of the fan horizontally or vertically through a wide angle. The ease of conversion from bracket to desk type is an attractive feature.

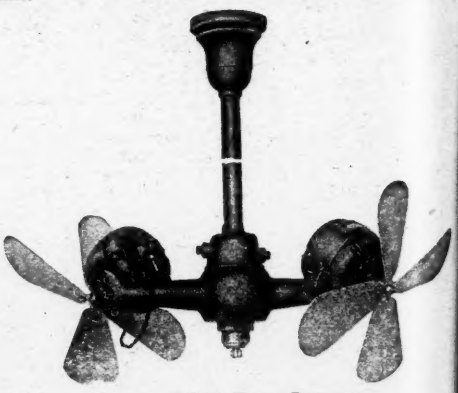

Fig. 2.—B.T.H. Twin Blower.

Fig. 3.—B.T.H. Exhaust Fan.

The oscillatory movement is provided by positive mechanism, and does not depend on air reaction.

The motor and fan can be made to oscillate through a predetermined angle. The list also shows ceiling type fans, one of which, a twin blower, we illustrate in fig. 2; we also illustrate an exhaust fan, fig. 3, these being built in 12-in. and 16-in. sizes for either direct or alternating-current working, and provided with a separate speed regulator.

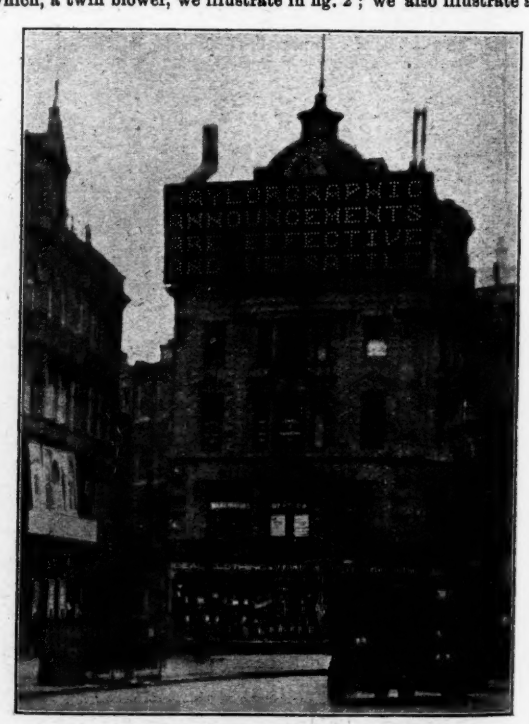

Fig. 4.—The Naylorgraph Day and Night Sign.

Electric Lighting of Ambulance Trains in France.

The electric lighting of ambulance trains for use on the Continent has presented some features of special interest, the running conditions being particularly exacting. Trains consisting of pharmacy and ward coaches have been built in this country by the Great Eastern Railway, the Great Western Railway, the London and North-Western Railway, and the London, Brighton & South Coast Railway, while several coaches have, at the order of the Red Cross Society, been supplied by the Birmingham Railway Carriage and Wagon Co.

These various units have been equipped throughout with Stone's system of electric train lighting, which has been adapted for service on coaches working to no fixed time-table and subject to long periods of standing and slow running. To meet the exceptional requirements of the case, use has been made of special dynamos, which are capable of doing the requisite current generation at a speed of but little more than 10 miles an hour. These machines are of the latest type, and are fitted with ball bearings. The supply is at 24 volts.

The lamp circuits are divided into two sections, so that either half lights or full lights can be used at will; moreover, individual control is provided on most of the lamps. Wall sockets also are fitted in several coaches, to facilitate the employment of portable lights.

The accumulators installed consist of double batteries of Stone's standard "Tonum" cells, and these give a "full lights" capacity of over 48 hours. It is unlikely, however, that all the lamps will be used at one time, hence the available storage is very great. With batteries of so large a rating and dynamos generating current at so low a speed, the installations are capable of satisfactory working, even under the most trying conditions.

The whole of the apparatus is of British manufacture, being supplied by Messrs. J. Stone & Co., Ltd., of Deptford, London, S.E.

LEGAL.

Underwood *v.* British Uralite Co.

This case was, on Thursday, April 22nd, the subject of an appeal by the defendants to the Divisional Court of King's Bench, before Justices Bailhache and Shearman, from a verdict and judgment in the action of Underwood *v.* The British Uralite Co., heard in January last by Judge Rentoul, in the City of London Court, when a jury awarded the plaintiff £71 damages for breach of contract. The matter was fully reported in our issue of February 5th, page 174.

Counsel for the appellants argued that the defendants had not entered into any contract with the plaintiff by which they were precluded from selling to Messrs. Kynock, and that there was no custom with regard to dealers which prevented them from dealing direct after the plaintiff had failed to purchase within the period of the option, there being no concluded contract of sale between plaintiff and Martin or between Martin and Kynocks.

Mr Justice Bailhache, after hearing lengthy arguments on both sides, said he was of opinion that the work done by plaintiff was not for the defendants, but in order that he himself might effect a sale. There was no implied contract to pay for services so rendered. What was done was done by the plaintiff because he was a person who had an option of purchase and was trying to find a purchaser from himself. He did not think the circumstances of the case supported the arguments of the plaintiff. If it were so, the defendants could not dispose of their machinery without a liability to pay the dealer for services rendered. The Judge in the Court below had wrongly directed the jury on that point. The other point put to the jury was that there was a custom that where a person had machinery to sell, and he went to a dealer and offered it to him for sale, and that dealer brought people to see it, the owner might not afterwards deal with the person whom the dealer had so brought. He did not agree with such a contention, and the evidence was not sufficient to support it or to establish the existence of a custom. The appeal must, therefore, be allowed.

Mr Justice Shearman gave judgment to a similar effect, observing that Messrs. Kynock had not gone behind the dealer to make their purchase, and there were no circumstances put before the jury to show that there was any liability to pay plaintiff for services rendered.

The appeal was allowed, and judgment entered for the defendants, with costs.

On the application of Mr. Doughty, appearing for the plaintiff, a stay of execution was granted with a view to appeal.

Osram Lamp Works, Ltd., *v.* Sceando Lamp Co., Ltd.

Mr. Walter, K.C., mentioned, on April 23rd, to Mr. Justice Younger in the Chancery Division, a motion in this action for an interim injunction to restrain, until the trial, an alleged passing-off by the defendants.

Evidence, he said, had been filed on both sides, and the conflict was such that he could not usefully ask his Lordship to deal with the matter upon affidavit evidence. He had agreed with the other side therefore that there should be no order on the motion except that the costs should be costs in the action.

His Lordship assented to that course being adopted.

Alleged Infringement of a Patent Vacuum Cleaner.

In the House of Lords on April 19th, 23rd and 26th, arguments were heard in an appeal by the British Vacuum Cleaner Co., Ltd., against an order of the Court of Appeal in favour of the respondents, James Robertshaw & Sons, Ltd.

The House consisted of the Lord Chancellor and Lords Strathclyde, Parker, Sumner, Parmoor and Wrenbury.

The action was brought by the appellants to obtain an injunction to restrain the respondents from infringing the appellants' letters patent No. 17,433 of 1901, granted to Hubert Cecil Booth for an invention entitled "Improvements relating to the extraction of dust from carpets and other materials," and for an inquiry as to damages and other relief. The specification stated that it was essential for practical success to drive by power the pump employed for producing a vacuum, and to maintain a vacuum of at least 5 lb. per sq. in. in the filter on the side of the filtering medium where the air and dust entered, when the apparatus was at work, and that it was only to extractors working with a considerable vacuum that the claims related. The first claim was for the combination of an extracting implement connected with a power-driven suction pump and dust-collecting means interposed between the said implement and pump, substantially as and for the purpose specified. The patent had been held by the House of Lords in a previous action to have subject matter and to be valid. The plaintiffs complained of threats and of actual infringement by the defendants' machines, which had suction bellows instead of a cylinder pump. The defendants pleaded that the patent was invalid on the ground of the publication of two specifications of Harvey, Nos. 516 of 1893, and 4,545 of 1894, and the prior user of machines made under Harvey's patent, and they denied infringement on the grounds—(1) that the patent sued on did not cover suction bellows although worked by motor, and (2) that the machine complained of did not work at substantially 5 lb. vacuum. Mr. Justice Sargant decided in favour of the plaintiffs, but the Court of Appeal by a majority (the Master of the Rolls and Lord Justice Swinfen Eady—Lord Justice Phillimore dissenting) considered that the term "a power-driven pump" could not be applied to a power-driven bellows, and that the defendants had done no more than apply power to the old Harvey machine. Lord Justice Phillimore considered that the essence of the plaintiffs' invention, as regarded the power-driven pump, was "the production by mechanical power of a suction such as will produce a considerable vacuum sufficient to extract the dust from and through the carpet, the extractor being a close fit." Accordingly, by the majority judgment of the Court of Appeal, it was held, notwithstanding the prior user of the machine of Harvey, that the patent was, on the construction placed on the specification by the House of Lords, valid; but that the defendants had not infringed, and the appeal was allowed. The plaintiffs now appealed against that judgment.

Mr. Thomas Terrell, K.C., Mr. Colefax, K.C., and Mr. Courtney Terrell appeared in support of the appeal; Mr. Walter, K.C., and Mr. Gray for the respondents.

On the hearing of the appeal the respondents were not heard, and judgment was reserved.

Armorduct Manufacturing Co., Ltd., *v.* Armitage.

In the City of London Court, on Monday, before his Honour Judge Rentoul, K.C., an action was brought by the plaintiffs against Mr. T. Armitage, electrical goods dealer, John Street, Huddersfield, for £21 balance of account for Sunbeam electric lamps supplied. Mr. F. Hinde appeared for the plaintiffs, and Mr. F. H. Bodvano for the defendant.

Mr. Hinde said that the defendant admitted owing £8 15s., for which plaintiffs had obtained judgment. As to the balance, £12 5s., there was no dispute about the receipt or acceptance of the lamps.

The matter was gone into in considerable detail, after which judgment was given for the plaintiffs for the amount claimed, with costs.

New Zealand.—The New Zealand Customs authorities have recently given a decision to the effect that "Igniters, electric (for gas or oil engines), are to be classified under No. 385 of the Tariff, a duty of 20 per cent. being imposed on foreign manufactures, while British goods are to be admitted free of duty."

A Wellington firm of importers is inquiring for the names of British makers of metal-filament lamps. Application may be made to the Board of Trade C.I. Branch in London.

Women's Work Exhibition.—At a "Women and Their Work" Exhibition, which is being organised by the *Daily Express*, and which opens to-morrow at the Royal Horticultural Hall, Westminster, for a period of one week, there will be daily demonstrations of electric cooking. On May 4th, at 3.30 p.m., Miss Maud Lancaster will lecture on "Electricity in the Service of the Home."

PARLIAMENTARY.

Halifax Corporation Bill.

Lord Newton's Select Committee of the House of Lords commenced the consideration of the Bill promoted by the Halifax Corporation on April 22nd. Under the Bill the Corporation sought powers to construct certain tramways and to provide and run trolley vehicles and motor omnibuses.

Mr. Lloyd, K.C., for the Corporation, explained that the principal tramway project was an extension to Elland, a mile and a half long, and this was opposed by the Huddersfield Corporation and the West Riding County Council. A second project was an extension of the tramway from West Vale to Stainland, and this also was opposed by the County Council. The promoters also wanted power to run motor 'buses along any street in the borough, along two specified routes outside the borough, and on any route which the Board of Trade and the road authority might eventually agree to. They were agreeable to contributing ¾d. per 'bus mile to the expense of maintenance of the roads, which was the sum generally fixed in other cases. Under the Bill they asked for borrowing powers of £110,000 for construction of tramways, £14,000 for tramway rolling stock, £5,100 for trolley vehicles, £26,300 for electrical equipment, £6,000 for an extension of the tramway depôt, and £3,600 for motor omnibuses.

Having heard the evidence the Committee rejected the proposal for the tramway to Elland, and also modified the clause which would have allowed the Corporation to make agreements postponing purchase by outside authorities. Clauses were also inserted to protect Huddersfield and Brighouse against competitive omnibus services from Halifax.

South Shields Corporation Bill.

A Select Committee of the House of Lords, presided over by Lord Hylton, after consideration of the South Shields Corporation Bill, has ordered it to be reported for third reading in a modified form. Amongst the proposals contained in the Bill were those for tramway extensions in the Mile End and Sunderland Roads, and for the running of motor 'buses to Boldon Collieries.

In the evidence it was stated that the Corporation had made an agreement with the Rural District Council with regard to the motor 'bus service and would contribute to the cost of the maintenance of the roads.

No opposition was offered to the tramway proposals, and the only opposition to the motor 'bus service was in respect of the wear of the roads and bridges.

The Committee rejected the motor 'bus proposal and allowed the tramway clauses.

WAR ITEMS.

Board of Trade Assistance.—The Board of Trade Commercial Intelligence Branch has issued list No. 17 of inquiries for sources of supply of goods, for the week ended April 17th.

Manchester Car Collections.—More than £10,000 has been collected for various war relief funds by means of the collecting boxes which have been on all the Manchester tramcars since the commencement of the war.

Glasgow University Engineers' Offer.—At the meeting of the Court of the University of Glasgow, on April 23rd, Principal Sir Donald MacAlister intimated that the whole staff of the engineering department—lecturers, assistants, demonstrators, and workmen in the laboratory—had offered themselves in a body to the military authorities in case their services might be of use in connection with the provision of munitions of war. He had had a letter from the Major-General of the Ordnance Department cordially acknowledging the value of the offer, and stating that in a very short time they would be able to indicate how the services of the staff might be best utilised. In the meantime the Admiralty had asked the University to do a service which they could do in connection with the actual work of providing munitions of war in Glasgow—namely, that they should put their workmen and their testing machines at the disposal of the Admiralty for the purpose of testing specimens of steel used in shell-making in the district. He was quite sure that Professor Cormack would undertake the supervision of this matter so far as providing facilities for the Government was concerned, and he was sure that the Court would cordially accede to the request.

Once Bit, Twice Shy.—Our contemporary "La Lumière Electrique" reproduces a letter which is being circulated by the Syndicate of Engineers, Boilermakers, and Foundrymen of France to all firms engaged in the trades named. After offering official statements on the war in six languages for circulation to foreign clients and agents, the letter points out that the Germans and Austro-Hungarians who were resident in France before the war, whilst ostensibly earning their living, were at the same time assiduously preparing for war, and urges its readers to guard against similar tactics in the future. To this end, all French concerns are adjured never more to employ Germans or Austrians in any capacity whatever; never to accept the gratuitous services of young Germans or Austrians who may present themselves as "volunteers"; and not to renew agencies for enemy firms after the war, but to deal in or purchase only apparatus, etc., of French manufacture, or, if not made in France, of Allied or neutral origin, the principle being to abstain rigidly, in view of the mentality that has been unmasked, from commercial transactions with the Germans. The Syndicate places its services at the disposal of readers, to furnish them with the names and addresses of French, British, American or other firms that make apparatus such as they have been accustomed to procure from Germany, or, in the case of items hitherto manufactured only in Germany or Austria-Hungary, to assist in the establishment of such manufactures in France. No doubt a similar feeling will be cherished by the majority of our readers. We wonder how many British firms that accepted the services of young Germans "desirous of learning the language" at a nominal price have paid for their seeming economy with the loss of customers worth tens of thousands a year to them, on the return of their artless pupils to the Fatherland, loaded with detailed information regarding their trade and clientèle. Nevermore!

German Capital in Russia.—Reuter's agent at Petrograd states that the Department of the Ministry of the Interior, which is in charge of rural and municipal economic affairs, has opened an inquiry into the question as to how far municipal economy in Russian towns is dependent upon German markets and German capital.

Electricity Works Employés.—It having been represented that men, some married with families, had enlisted from the various Stoke Corporation electricity works, and that their places had been filled by single men of military age, Colonel Blizzard asked Mr. Yeaman, the electrical engineer, to make inquiries. The subject was brought before the Electricity Committee, and Mr. Yeaman was instructed to reply that the Electricity Department had sent a larger percentage of men than any other department of the Corporation—30 per cent. of its employés having enlisted, and 44 per cent. from the office staff. The general allegation of taking on single men of military age was disputed, but it was stated that the greatest difficulty had been found in obtaining men, and that a few more who would enlist were unable to do so because they could not be spared, particularly as the War Office, the Local Government Board, and local firms insisted upon an adequate supply of electricity being maintained for the production of munitions, etc. Mr. Yeaman concludes:—"I think you will agree that everything possible has been done by my committee to forward the interests which we fully recognize are national and not local, reserving merely the irreducible minimum for our own pressing local needs."—"Stafford Advertiser."

German Electrical Machinery Confiscated at Sydney.—An Australian newspaper just to hand states that application was made to Sir William Cullen, President of the Prize Court, for the confiscation of seven cases of machinery seized on board the steamer "Annam" by the Commonwealth Government. The application was made by Mr. H. E. Manning, who was instructed by the Commonwealth Crown Solicitor; Dr. Brissenden appeared for the Australian Metal Co., Ltd.; and Mr. P. Halse Rogers, for the Municipal Council of Sydney. Mr. Manning explained that in 1913 a contract was entered into between the Australian Metal Co., Ltd., and a German firm for the supply of certain electrical machinery, to be ultimately used by the City Council. The original machinery was supplied and set up, but it was afterwards discovered that certain parts were defective. The Australian Metal Co. undertook to replace the defective parts, and in order to do that it was necessary to send to Germany. This was done in June, 1914, but it was not until September 29th, 1914, that the goods were shipped by the German firm, via Copenhagen. The vessel arrived at Sydney long after the outbreak of war, the cargo was discharged, and the goods in question were seized by the Customs authorities. The Australian Metal Co. had no communication with the German firm after the outbreak of war. The object of the present application was to obtain an order from the Court confiscating the goods, which would be ultimately handed over to the City Council. The President said it was proved that the goods were ordered prior to the outbreak of hostilities, and the Australian Metal Co., who were merely carrying out the Council's order, were exempted entirely from any suggestion that they were trading with the enemy. The goods, however, having been dispatched from an enemy's country after a state of war existed, must be confiscated, and he made an order accordingly; no order as to costs.

Trading with the Enemy.—The "Australian Mining Standard" states that Colin Leigh Remington, trading in Elizabeth Street, Melbourne, under the name of McLean & Co., electrical engineers, was arrested in March and charged that "during the continuance of the present state of war, on September 3rd, 1914, at Melbourne, he did unlawfully attempt and unlawfully endeavour to trade with the enemy, to wit—C. & F. Schlothaner, Ruhla, Germany; M. Reiner & Co., Hamburg, Germany; Schumanns Elektrizitatswerk, Leipsig, Plagwitz, Germany." Having been released on £500 bail, he came before Mr. Goldsmith, P.M., at the

Melbourne City Court on March 12th, to answer the charge. Mr. H. I. Cohen, who prosecuted, explained that accused was arrested because it was known that he was booked to leave for America on March 13th. Several letters to firms mentioned in the charge having been read, and Mr. Bryant having, in defence, argued that even after the proclamation prohibiting trading with the enemy, it was perfectly justifiable for a person in Australia or England to buy German manufactures from persons in neutral countries, provided the money in payment did not go to Germany, and the accused having stated that whatever he had done against the law had been done in ignorance, the Police Magistrate stated that he had no doubt that defendant had offended against the law. He could not understand how a business man could, within a few days of each other, have written such contradictory letters as two which had been read. If it was not attempting to trade with the enemy he did not know what was. He should say it was non-controversial. It was the sort of thing that could not go on. The thing that appeared to mitigate the offence was that it occurred on September 3rd. He (Mr. Goldsmith) did not regard the case as so grave as the matter that was before him some weeks ago, where an endeavour was made not only to obtain goods through a neutral country, but to have them branded as of other than German manufacture. In view of the circumstances, and the fact that the defendant had abstained later on from giving directions, the fine would be £200, with £6 6s. costs. Mr. Goldsmith added that in charges of this nature which might in future come before him, unless there were markedly mitigating circumstances in such cases, even though they were committed anterior to the first case he had heard, he would order imprisonment. Those who traded with the enemy supplied them with munitions of war to destroy our soldiers.

Reuter's agent at Melbourne telegraphs, according to the "Financial Times," that Theodore Zwicker, an importer, has been fined the maximum penalty of £500 for attempting to trade with the enemy.

The German Cable Makers' Syndicate.—Shortly after the outbreak of war the agreement of the Syndicate of German Cable Makers, which was on the point of expiration, was provisionally prolonged until the end of March, 1915. This temporary arrangement has now been extended to the close of the year. It is proposed to protract the combination definitely for a number of years after the conclusion of peace. The chairman of the Syndicate is Herr Berliner, general director of the Bergmann Electricity Works Co.

Anglo-Russian Trade Relations.—One of the features of the Anglo-Russian commercial entente, initiated some eight or nine years ago, was the establishment, contemporaneously, in London and Petrograd, of the Russian Section of the London Chamber of Commerce and the Russo-British Chamber, respectively. The latter has now branches in Warsaw, Odessa, and other leading Russian cities; the former includes in its membership practically all corporations and firms, financial and commercial, of any standing and importance in London, whether British or Russian, who are interested in trade between the two countries. The work that has been accomplished in the intervening years has placed the organisations in question in a position to meet the new situation brought about by the war in a manner that would obviously have been impossible without a lengthy period of preparation. The Russian Section of the London Chamber of Commerce has at its disposal not only the large resources of that institution but the services of the special Statistical and Information Department of the Chamber, with its extensive commercial library. This department has been putting Russian buyers and English sellers, or vice versa, into business relations for some years now, but naturally since the outbreak of war this work has been very greatly extended. The department affords full information as to the products obtainable in each country and the manufacturers and merchants dealing in the various articles; the statistical and other information, as well as the experience gained in the past, is now of great benefit. At the present moment the Chamber is busily engaged in applying its resources with the object of meeting the present demands arising both here and in Russia, and, no doubt, the coming of summer and the re-opening of the trade routes connecting the two countries will again increase the work. The work of the Section is not, however, confined to introducing buyer and seller; many other subjects are handled. For example, at the meeting held on 23rd instant, a special committee was appointed to carry on the work initiated by an emergency committee nominated immediately after the outbreak of war, which will watch, in the interests of Anglo-Russian trade, negotiations for commercial treaties which may be concluded by Russia with various countries when the war is over. The committee, in addition, will consider all questions bearing on the general subject of the extension of trade between Great Britain and Russia which may arise in the interim. Particulars of the new Russian Customs Tariff which, broadly speaking, increases the duties on British goods by 10 per cent., and on those from Germany, Austria-Hungary, and Turkey by 100 per cent., were announced. The result of correspondence with the Censor on the subject of transmitting telegrams in the Russian language was also communicated, whilst among other subjects which were discussed with a view to action was the effect of Clause 5 of the Finance Act, 1914, upon Russian shareholders in British companies operating in Russia, etc. A proposal for an exhibition of British goods in Russia was also discussed and deferred for further details.

Belgium's Hour of Need: An Appeal.—In common with the editors of other publications, we have this week received an appeal on behalf of the millions of people who are on the verge of starvation in Belgium. We wish that we had room to print it. It is eloquent, convincing, and heart-searching—we cannot attempt to summarise its arguments in a few words. True, great things have been done to enable those seven millions who remained behind in Belgium to keep body and soul together, but it is too horrible to contemplate the suffering, mental and physical, and the pangs of hunger, that we are authoritatively informed these brave people have undergone, and which they must yet experience while in the German grip unless more generous help is sent. The German army of occupation refuses to feed them, and "unless we get more assistance hundreds of thousands will actually starve." We have opened our columns in these terrible war-days to many appeals not purely electrical, but we are sure that there is none that can with greater justice lay claim to our assistance. The appeal of the National Committee for Relief in Belgium is signed by representatives of varied interests, and the committee has among its members men and women from almost every conceivable walk in British life, and we have no hesitation in urging our readers—all of whom recognize the vast debt we owe to Belgium—to do their utmost for these millions who suffer because of the immortal bravery of our Ally in defending its own honour and obstructing the way to Paris, to Calais, and, perhaps—to London. Donations may be sent to Mr. A. Shirley Benn, the Hon. Treasurer, Trafalgar Buildings, Trafalgar Square, London, W.C.

Engineer Volunteer Training Corps.—The replies received to the circular recently issued by the Institution of Electrical Engineers to the members residing in the London district have been communicated to the Central Association of Volunteer Training Corps, whose Engineering Adviser is of opinion that the response received is sufficient for the matter to be proceeded with, and enrolment forms have accordingly been sent to all those who have expressed willingness (conditional or unconditional) to join the proposed Corps. Further enrolment forms for members whose residence or occupation is in the London district can be obtained at the Institution of Electrical Engineers, Victoria Embankment, W.C.

German-Russian Electric Finance cum Force Majeure.—According to the "Utro Rossi," Moscow circles are credibly informed that a lively business is being done in Brussels in the transfer of German concerns in Russia to Belgian share companies which have been established for the purpose. The acts of sale take place with the observance of all legal formalities, and are registered at the Spanish Consulate, scrupulously fulfilling the obligations of the Russian Consulate. All this is done in the expectation of using the Belgian firms and preserving in German hands the power to control the concerns in Russia which according to the existing law they should lose. The Belgian Government has accurate information showing that up to now 38 such transactions have been registered, of which seven are related to the General Electricity Company-trust, which was interested before the war in electrical undertakings in Riga, Keiff, Bielostok, Radom, Chenstochoff, and Simferpol. Nearly all the shares in the Kieff Lighting Company have now been transferred, of course, fictitiously, to it. In exchange for them German shareholders will receive shares in the Belgian trust. Our Allies, continues the Russian journal, are obliged to execute the operations under German compulsion. After the war they will explain them, and they will be cancelled. But for the edification of the presumptuous Germans, it would do no harm to put existing law into force on the liquidation of German businesses in Russia, with a clear intimation that the transfer of such businesses, effected no matter how, abroad, will be treated as null and void in Russia.

Personal.—The following announcements appeared in the "London Gazette" on April 27th:—Territorial Force: Hampshire (Fortress) Engineers. The undermentioned to be Second Lieutenants. March 25th:—No. 4 Electric Lights Company—Sapper Harold Tom White. No. 6 Electric Lights Company—Norman Mansfield Radermacher.

London Electrical Engineers: The undermentioned to be Second Lieutenants. Dated April 28th, 1915:—Corporal Thomas Hepburn Gotch, Lance-Corporal Gerald Fergus Wood, Private Alfred Blackie, from the 28th (County of London) Battalion, The London Regiment (Artists Rifles).

Mr. A. R. Farrow, who has been gazetted Second-Lieutenant in the R.F.A. (2nd Home Counties' Brigade), is the son of Mr. A. E. Farrow, manager of the Windsor Electric Light Works, and was a pupil in the Diesel Engineering Works at Manchester.

Roll of Honour.—Private John Hoose, of Frodsham, who was employed at the Helsby Cable Works before the war, has been killed in action. He was serving with the 2nd Welsh Regiment, and was shot in the head. Deceased, who had previously been wounded and had returned to the front, has left a widow and two children.

Lance-Corporal Walter Hewett and Private Charles Webber, who were arc lamp attendants in the employ of the Stepney B.C. electricity department, have been killed in action.

BUSINESS NOTES.

Consular Notes.—GERMANY.—The American Consul at Berlin reports that the merchants of the city of Berlin have taken preliminary steps to quote hereafter, when normal times have arrived, independent prices for zinc, lead, aluminium, and antimony. This measure involves the further extension of the activities of the Berlin Metal Exchange, and its prime object is to create independence for the German metal trade from the quotations in London. The American Consul is of opinion that this proceeding is justified in view of actual conditions in the relative production and consumption of metals in the various European countries. He considers it an anomaly in the metal trades that the price of zinc, for instance, of which Germany is one of the foremost producers and consumers, is fixed in London.

INDIA.—The American Consul at Bombay reports that the Railway Board of India has issuedinstructions to install electric lighting in all carriages on State worked railway systems. The change will of necessity take time to carry out, but the general adoption of electric lighting has now been decided on and will gradually be brought about as funds and time permit.

Stoker Contracts.—The following is a list of recent sales of stokers by the Underfeed Stoker Co., Ltd., to electrical undertakings:—

Borough of Leigh Electricity Department	2 E.
Lisbon Electric Tramways	1 E.
Derbyshire & Nottinghamshire Electric Power Co. ..	6 B.5
Blackpool Corporation Electricity Department.. ..	2 E.

Other orders executed include those for Priestman Collieries, Newcastle-on-Tyne; Davidson & Co., Belfast; Edward Sassoon Mills, Bombay; National Steam Car Co., Chelmsford; and the Delagoa Bay Development Corporation.

Catalogues and Lists.—Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, London, E.C.—Small illustrated and priced leaflets of lifting magnets, electric drills, and electric blowers. The company's telegraphic address has been changed from "Aphasitic-Cannon-London," to "Westoleleo-Cannon-London."

The Edison & Swan United Electric Light Co., Ltd., Ponders End.—Leaflet No. H 3,097 gives prices and particulars of domestic fans for the coming summer season. Customers can have these overprinted in quantities of 250 up. Leaflet No. A 3,096 (8 pages), gives details and reduced prices of "Ediswan" fool-proof, quick-make and quick-break ironclad switches and switch fuses (250 and 600 volts)

Mr. G. Braulik, 8, Lambeth Hill, London. E.C.—Twelve-page illustrated catalogue giving fully tabulated details and prices of "Therma" electric cooking and heating apparatus—boilers, cooking plates, ranges, baking and roasting ovens, &c.

Contraflo Condenser and Kinetic Air Pump Co, Ltd., 3, Central Buildings, Westminster, London, S.W.—Thirty-two-page illustrated pamphlet, containing a very full description of the Contraflo-Kinetic system. The pictures show these condensing and air-pump equipments applied to power station plants in Buenos Aires, Japan, China, Rochdale, Lots Road, Dunston, Bolton, &c. A tabular list gives particulars of Kinetic plants supplied or on order, ranging from 500 to 25,000 kw.

Messrs. Geo. Schultz & Co., Ltd., 10, Bush Lane, London, E.C.—New catalogue (24 pp.) giving particulars and prices of various electrical insulation materials which they are now manufacturing at Manchester. They have recently acquired additional premises, increasing their output facilities, and considerable stocks are carried of these and other manufactures, including enamel insulated wire.

The General Accessories Co., Ltd., 70, Worship Street, London, E.C.—Eighty-six-page catalogue containing illustrations and prices of electrical accessories of British manufacture—lamp-holders, switches, bells and bell-pushes, fuse and distribution-boards, and so forth.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Illustrated priced leaflets relating to carbon-filament lamps and Barwick motor-starters.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—Twelve-page illustrated list (S. 38) giving full particulars, with diagrams, prices, &c., of their "Pivot" single-way and two-way tumbler switches.

Messrs. Herbert Morris, Ltd., Empress Works, Loughborough.—Illustrated and priced pamphlet, No. 62, relating to their standard pulley-block, crane, runway and other manufactures.

Messrs. Rose Bros., 38 and 39, Beech Street, London, E.C.—Eight-page illustrated catalogue of electrical instruments made by the Compagnie F A.C. Da and Dutilh, of Paris, for whom the firm are sole British agents. Pocket, switchboard, and motor-car and lamp-testing instruments are shown and priced, also accumulator charging boards.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Illustrated and descriptive price leaflet of the "No-Cell" dynamo outfit for motor-cars, giving head-light illumination without accumulators.

British Thomson-Houston Co., Ltd., Rugby.—List No. 2,255 (8 pp.), giving full description and tabulated dimensions of their new type D.Q. continuous-current motors, ranging from 0·15 to 10 h.p.

The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, King's Cross, N.—New list of mercury vapour converters for transforming alternating to direct current, which are made up to 80 amperes at 250 volts, single and three-phase, and are guaranteed for stated periods.

The Electric and General Works, Ltd., 15, Victoria Street, London, S.W.—Illustrated leaflet showing switches, circuit-breakers, motor control boxes, protective apparatus fuses, and other apparatus, of which they have a collection of samples on view at the above address.

Electrical Supplies Co., 53, Victoria Street, London, S.W.—Folder giving prices of electric bells, which are made in a London factory.

Messrs. Alfred Herbert, Ltd., Coventry.—The firm's *Monthly Review* of modern machine shop practice for April contains a good deal of useful information, and includes an article on electrical machinery, written from the standpoint of the man who has charge of such plant.

Gears and Pinions.—Messrs. Scholey & Co., Ltd., have received a contract for tool steel gears and pinions from the Croydon Corporation Tramways Department. They have also recently received large orders from the following:—

The Oerlikon Co. (L. & N.W. Railway electrification).
L.B. & S.C. Railway.
East Ham Corporation Tramways.
Pretoria Municipality.
Colombo Electric Tramways & Lighting Co.
Johannesburg Municipality.
Auckland Electric Tramways Co.

Private Arrangements.—Harry J. Booker, electrical engineer, 51, Tothill Street, Westminster, London, S.W.—A meeting of the creditors of the above was held on Monday at the offices of Mr. James Mortimer, accountant and auditor, 3, Pancras Lane, Cheapside, E.C. Mr. P. Houstoun, who represented several of the creditors, was elected to the chair. The statement of affairs presented by Mr. Mortimer showed liabilities of £1,043. The indebtedness to the trade was £923, and the balance of £120 was due to Mr. J. Grevener for cash advanced. The assets consisted of cash at bank, £55; stock-in-trade £19, expected to produce £10; book debts £611, estimated to realise £580; and motor-car, £100. The assets therefore totalled £746, or a deficiency of £298. Mr. Mortimer stated that the debtor was seriously ill, and was at present at Yarmouth. Up to a recent date he had been in a Sanatorium, and had been in ill-health for some months. Owing to pressure by a creditor he consulted his solicitor, and it was then decided that an investigation should be made. The debtor gave instructions for the investigation, and said that if it was thought necessary the creditors should be called together. The debtor only started business in March of last year, and he then had a small capital, but he owed money to Mr. Grevener, and he probably only had an excess of assets over liabilities of about £15. The books had not been properly kept, but as far as could be seen the purchases had amounted to £2,245, while the sales had been £2,590. In answer to questions, Mr. Mortimer said that the debtor would not make any offer. But for the war the present position would not have arisen. The debtor dealt chiefly with German manufacturers, and he had not been able to get his supplies. Nevertheless, had it not been for his illness, the debtor would probably have made the business a success. After a short discussion it was unanimously decided that the estate should be dealt with under a deed of assignment, with Mr. G. E. Corfield, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., as trustee. The following are creditors:—

Adnil Electric Co.	£200	Barnes, F. J.	£85
Electric Power Eng. Co., Stechford	26	British Westinghouse Co. ..	80
Falk, Stadelmann & Co... ..	24	Medway's Safety Lift Co. ..	10
General Cable Mfg. Co... ..	80	Midland Electric Co.	14
Hogan & Wardrop	40	Morris, P. D.	42
Imperial United Lamp Co. ..	137	Northern Electric Wire Co. ..	164
		Watlington & Co...	11

Fardon & Carpenter, Ltd., electrical engineers, 4, Maidenhead Court, London, E.C.—A meeting of the creditors of the above was held last Friday at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. Mr. G. E. Corfield, the liquidator of the company, presented a statement of affairs which showed liabilities of £621, of which £389 was due to the trade and £232 to "other creditors." The assets consisted of cash in hand £291, and book debts £105, estimated to realise £65. The assets thus totalled £356, or a deficiency as regarded the creditors of £265. It was reported that the company was registered on December 31st, 1913, with a nominal capital of £2,002, and that it took over the business of the Emerson Works. The company had issued debentures for about £300. Last October the debenture-holder appointed Mr. Carpenter as receiver and manager. He had since sold all the assets, paid off the debenture, and after deducting the costs and expenses there was a balance remaining of £291, which he had handed over to the liquidator. The "other creditors" referred to in the statement of affairs were principally in respect of claims by the directors under agreements with the company. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Corfield as liquidator. The latter stated that it was a simple liquidation, and that as soon as the book debts had been collected a dividend would be paid.

Australia.—A Brisbane firm desires to secure agencies of British makers of engineering specialities, electric cranes, and other machinery requiring expert handling. Application should be made to the Board of Trade Commercial Intelligence Branch, in London

Book Notices.—*First Principles of Production.* By J. T. Peddie. London: Longmans, Green & Co. Price 5s. net.—Herein the author essays a study of the first principles of production and the relation of science to industry and to evolve a basis for a new Imperialism—truly a formidable task, but one which he performs with a considerable measure of success. We take issue, however, with the very first sentence of his introduction, and much regret that such an unfortunate sentiment should be given such prominence. "At the conclusion of the great war," writes Mr. Peddie, "it will be necessary for the leaders of British industry and science to take stock of their positions." At the conclusion of the war it will be too late to do any such thing. The primary needs of the moment are well known, and they must not be neglected in the least degree, but amid all the stress and strain of turning out munitions of war on an unprecedented scale, our leaders of industry and science must find time to mend their ways of peace and see that our new industrial and commercial policies are in full working order on the first day of peace, wherever the war prevents their earlier application. The first day of peace will be the first day of an industrial war for which we must be prepared—for which we must now prepare—and the outstanding omission from Mr. Peddie's book is neglect to insist sufficiently on the need for instant action by every industrial leader and manufacturer, each in his own field. With Mr. Peddie's estimate of the evil effects on us of the reduced standard of wages and living in Germany after the war, we are in entire agreement. We suggest only that he over-estimates the advantage we have in the "breathing space now afforded us." In point of fact, we must rely on no period of grace.

Matters in which it is easy to agree with the author are the necessity for giving greater pecuniary support and recognition to science and scientists; the rank folly of splitting our industrial barque on the reefs of political interest and dogma; and the desirability of improving our technical education facilities, particularly in respect of really efficient commercial training. The short paper which gives its title to this volume represents a sound, general survey of the classes of our community and the factors going to make up cost of production; it is followed by a yet shorter paper (about 1,700 words) on "The State and Opportunity in Industry." An essay on Tariffs, Free Trade and Industry insists upon the indivisibility of tariff and free trade problems, and presents several fresh arguments on this hoary subject. In discussing the "Influence of Science on Political Economy," the author's chief point is that political economy must be adapted to and judged by the period to which it applies. We are given an interesting review of the past effects of invention, scientific developments and tariff changes on industrial expansion, but we seek in vain for any definite practical suggestions for present action. A paper on "Finance and Industry" points out the advantages, limitations and dangers of German banking policy, and we agree that industry must show that it is prepared to operate on efficient and truly scientific bases before it can receive satisfactory support from banks. This essay is followed by a brief compilation, laying emphasis on the importance of science in industry and presenting several striking instances of German methods and achievements. The remainder of the volume is chiefly devoted to reprints. The work is not indexed, and, though well worth reading, it does not unfold any organised, continuous policy for immediate application. Though much may be done by co-operation and State action in the near future, the immediate necessity is for reform along well-known lines by individual firms in details and ramifications of their methods and activities, which are known only to themselves, and can be set in order only by effort from within.

"*Bulletin* No. 77. Bureau of Mines." "The Electric Furnace in Metallurgical Work." "Fourth annual report of the Director of the Bureau of Mines," for the year ended June 30th, 1914. Washington: Government Printing Office.

"Wiring of Finished Buildings." By T. Croft. London: Hill Publishing Co. Price 8s. 4d. net.

"Business Methods and the War." By L. R. Dicksee. London: Cambridge University Press. Price 2s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV. No. 4. April, 1915. New York: The Institute. Price $1.

"*Proceedings* of the Physical Society of London." Part XXVII. Part 3. April 15th, 1915. London: The *Electrician* Printing and Publishing Co. Price 4s. net.

"Science Abstracts." Sections A and B. Vol. XVIII, Part 4. April 26th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each net.

The Truth about the Sino-Japanese "Conversations." London: The Chinese Students' Union

Dissolutions and Liquidations.—Messrs. Cooper and Roberts, electrical and engineering merchants, 3, Paul's Bakehouse Court, Godliman Street, London, E.C.—Messrs. J. N. Cooper and E. Roberts have dissolved partnership, the latter having joined the Army. Mr. Cooper is continuing the business under the same style, and will attend to all debts.

Hove Electric Lighting Co., Ltd.—A meeting will be held at Salisbury House, London Wall, E.C., on June 2nd, to hear an account of the winding up from the liquidator, Mr. F. R. Reeves.

Colne and Trawden Light Railways Co.—A meeting will be held on May 24th, at Albion Works, Armley Road, Leeds, to hear an account of the winding up from the liquidator, Mr. G. G. Davies.

The Electromobile Co., Ltd.—A meeting will be held on May 31st, at Sardinia House, Kingsway, W.C., to hear an account of the winding up from the liquidator, Mr. S. Cole.

An Italian View of the Russian Market.—The Italian Consul General at Moscow reports as under on the mode of cultivating the Russian market:—"If there is a desire in Italy to successfully prosecute Russian trade from Moscow it behoves our manufacturers to set about the business seriously. Under the special circumstances ruling here it is needful that the representative in Moscow should possess the following qualifications:—(*a*) At least an approximate knowledge of Russian; a foreign tongue, even if it were French, would immediately be met with diffidence. Little sympathy is extended to a foreign tongue and its use can only eventuate in prejudicing a dealing. (*b*) The possession of ample funds for advertising and other expenses. (*a*) The possession not only of catalogues, but of a full range of samples, for the Muscovite merchant is averse to buying without the sight of samples. There are at Moscow a number of Italians and other foreigners who are in a position to take up such representation. It would be an illusion to consider that the conquest of this market is an easy matter, for Japan, on one hand, and England on the other, have already been very active, with the same object, since the outbreak of the war; and, moreover, are able to offer the following advantages:—(*a*) More easy and more direct transport: (*b*) greater credit facilities, for English and Japanese manufacturers and exporters are in the habit, in this extraordinary period, of granting facilities for payment, whereas Italian merchants are always obdurate and diffident; it should, however, be borne in mind that it is needful to risk something in the first transactions. Italian merchants should quote lower prices for orders from Russia than from other countries, as do both England and Japan. Italian manufacturers are certainly right in selling their products to the highest bidder, but the Muscovite is also right in refusing to buy from Italy an article at 10, which he can obtain from Japan and England at 9. While, therefore, continuing to sell to other countries at 10, our manufacturers should examine the question, and see if it is not worth while selling at Moscow at 9, bearing in mind that the Muscovite market, with its infinite and insatiable hinterland in Europe and in Asia, and a yearly trade movement of 5 milliards of francs, will always continue to buy, even when the war is ended. This certainty is a subject worthy of our greatest attention."

Bankruptcy Proceedings. — James Proctor Kyd Clark, lately trading as an electrical and mechanical engineer, at Hythe Road, Willesden Junction, N.W., under the style of George Driver & Son.—The public examination was held last week before Mr. Registrar Hood, at the London Bankruptcy Court. The debtor applied to pass upon accounts showing total liabilities £2,167 (unsecured £222), and assets *nil*. Replying to Mr. Daniel Williams, Official Receiver, the debtor stated that having previously been in employment, he, in 1895, became a partner with two other persons in the business of electrical and mechanical engineers carried on at Euston Road by Mr. G. H. Driver, an inventor. Witness put in £500 capital upon being admitted a partner. During 1900 Mr. Fladgate, one of the partners, retired from the business, upon an undertaking that the remaining partners should pay him 5 per cent. interest on £1,500 capital which he had left in the firm. In the previous year the business had been removed to Willesden Junction. It was part of the arrangement with Mr. Fladgate that in the event of the interest falling three months in arrear the principal amount was to become recoverable, and that in the event of Mr. Fladgate's death the interest should be paid to his sister during her lifetime. Mr. Driver, the other partner, died in November, 1903, his capital being then agreed at £1,600, which witness paid to the representatives of the deceased, giving them at the same time a release from any possible claim in respect of the Fladgate liability. Witness further arranged with the latter gentleman to pay off one-half of the said £1,500 by instalments, and to continue the payment of interest on the other half. He had only paid, however, £250 off the principal amount, but continued the business alone until November, 1914, when, owing to lack of capital and pressure by creditors, he transferred it, as from September 30th, 1914, to his manager. Generally speaking, it had been a successful business, and the balance-sheet for the year ended March, 1914, showed a profit of £1,400. It, however, suffered by the lapse of patents and heavy competition. The debtor was examined at considerable length with reference to the disposal of his business, and was asked whether he did not get rid of it in order to defeat a judgment creditor. He asserted that his chief reason was that he was anxious to get into the motor-boat service and go to sea, but he frankly admitted that the result of the transaction was to leave the judgment creditor entirely out in the cold. The examination was concluded.

The Prentice "Lightning" Cooker.—The Armorduct Manufacturing Co., Ltd., ask us to state that owing to certain rearrangements which are being made at their Witton Works, they have decided to relinquish the manufacture of Mr. Napier Prentice's "Lightning" cooker, for which they held the sole licence. They state that other engagements prevent them from doing justice to Mr. Prentice's interests in the development of the cooker at present, and they understand that Mr. Prentice will be making arrangements for the manufacture of the cooker by some other firm.

Denmark.—A Copenhagen merchant wants agencies for British makers of electrical fittings and accessories, insulators, meters, dynamos, small motors, fans, pumps, &c. Application should be made to the Board of Trade O.I. Branch in London.

Trade Announcements.—The British Electric Transformer Co., Ltd., have now closed their offices and showrooms at Charing Cross House, 29A, Charing Cross Road, London, W.C., and all further communications should be sent to them direct at Hayes, Middlesex. Telegraphic address: Transfundo, Hayes, Middlesex. Telephones: 226 Ealing; 101 Southall; 12 Hayes (local calls).

The Century Electric Co., of St. Louis, U.S.A., informs us that it has increased its capital stock (fully paid) to £200,000, to enable it to more readily care for the rapidly increasing demand for its products.

The Equipment and Engineering Co., of Westinghouse Building, Norfolk Street, Strand, W.C., announce that their new telephone number is "City 1088" (two lines).

The Kingolite Co., Ltd., of Pyke House, Oxford Street, and Soho Square, W. (of which Mr. William J. Owen is managing director), have disposed of their business in electrical accessories and silk shades to the Edison & Swan United Electric Light Co., Ltd. The Kingolite Co.'s Works, together with practically the whole staff, have been transferred to Ponder's End, while Mr. Owen, having accepted a position with the Edison & Swan Co., continues to superintend the business he has been instrumental in establishing.

Messrs. Garnish, Lemon & Co., Ltd., of 12, Pilton Street, Barnstaple, have taken over the business of Mr. C. W. Cockram, electrical engineer, 112, Bomtport Street, Barnstaple, and have appointed Mr. Cockram as manager.

The B.E.A.M.A.—The following firms have recently been elected members of the B.E.A.M.A.:—The Mirrlees Watson Co., Ltd.; John Musgrave & Sons (1913), Ltd.; Newton Bros., Derby; Isaac Storey & Sons, Ltd., Branch of United Brassfounders and Engineers, Ltd.

LIGHTING and POWER NOTES.

Aldershot.—Proposed Loans.—The L.G.B. having intimated to the U.D.C., which had applied for a loan of £8,500 for electricity purposes, that no loans were being granted except in cases of pressing necessity, the Council has decided to point out that the work needed is pressing, as current is being supplied to firms engaged on army contracts. Tenders received for additional plant have been referred to the Lighting Committee.

Argentina.—The Compania Italo-Argentina de Electricidad recently inaugurated its No. 2 power house, situated in Calle Tres Sargentos. The new station now serves the important area comprised between Callao, Avenida de Mayo and Paseo de Julio. The Tres Sargentos power station is the largest of the numerous minor stations. It has a capacity of 8,000 to 10,000 H.P. The third station, situated at Calle Balcarce 547, will be opened to public service in a few weeks. These three stations, in conjunction with three others in construction and with the large central power station in the Boca, will enable this company to meet all demands in the central part of the city.—*Review of River Plate.*

Blackpool.—Year's Working.—The total income of the electricity department for the year just ended was £47,326, an increase of £2,330; and working expenses amounted to £24,066, while interest and sinking fund charges came to £14,761. The profit was £8,499, or over £1,000 more than a year ago. During the coming year it is expected to make a profit of about £5,000. There are 2,870 consumers, the new customers during the year numbering 409.

Bolton.—L.G.B. Inquiry.—An inquiry was held on April 22nd into an application to borrow £45,032 for the electricity undertaking. The first part of the inquiry related to £23,032 for converter and other plant, necessary in order that full benefit might be obtained from the new works at Back-o'-th'-Bank. It was explained that there were four systems of supply at Spa Road works, requiring different plant for each, and the cost of generating would be substantially reduced if the whole supply could be generated by one plant. The Committee proposed, therefore, to transfer generation from Spa Road to Back-o'-th'-Bank, and by altering the system of distribution the department would be saved £8,714 per annum. The Town Clerk intimated that the Corporation had suspended other works on capital and revenue account to the extent of something like £275,000, in order to comply with the requirements of the Board and the Treasury.

The other part of the inquiry related to £5,000 for the equipment of sub-stations on consumers' premises, and £17,000 for mains. There was no opposition.

Buckhurst Hill.—Prov. Order.—The County of London Electric Supply Co. has informed the local authority that it has decided not to proceed with the application for a prov. order for E.L. at Buckhurst Hill, Woodford, Wanstead and Chigwell.

Bury.—The Corporation Electricity Committee was informed last week that while excavations were being made for the foundation of the retaining wall in connection with the Chamber Hall electricity works extensions, a seam of coal had been discovered, and that some tons of coal had been obtained and used at the works.

Cahirciveen.—E.L. Scheme.—In connection with the electric lighting scheme, Mr. W. J. U. Sowter, of Bray, has been instructed to report on the plans and specifications submitted by the Ampere Electric Lighting Co. Application has been made to the Irish Congested District Board for permission to build the power house and works; as soon as this is granted and the plans approved the work will be proceeded with.

Castlewellan.—Street Lighting.—The *Belfast News Letter* of April 23rd states that at a meeting held on April 22nd it was decided to accept the proposal of the Irish Town Lighting Co. to generate and supply electricity for 40 street lamps, at £40 per annum.

Chile.—The electric light company of Santiago recently informed the municipality that unless its debt of $1,500,000 for electric light was paid, the contract will be annulled.—*Review of the River Plate.*

Clacton-on-Sea.—L.G.B. Inquiry.—An inquiry was held last week into the application of the U.D.C. for a loan of £1,300 for a new battery at the electricity works. The engineer reported that to keep the old battery in its present condition would cost from £100 to £150 a year. The Council, it was stated, had contracted with the D.P. Battery Co. for a new battery at a cost of £1,690, with an estimated allowance of £429 for old material, and the work had been commenced in anticipation of a loan being sanctioned. There was no opposition.

Continental.—Russia.—The Russian journal *La Cause Municipale* has recently made an inquiry into the electric installation schemes projected in the various Russian towns and cities. It appears that electric lighting installations are contemplated in the following municipal areas:—Armiansk, Atchinsk, Bobronysk, Borovitchi, Borzna, Chadrinsk, Gorodok, Jakobstad, Jamburg, Jaransk, Jenisseysk, Kamychlov, Kinechma (concession), Krasnokoutsk, Kobelaki, Kolomna, Korotcha, Koustanai (concession), Lenkoran, Neavige, Novgorod, Novo-Alexandrovsk Osa, Ostrov, Penza, Poltava (new station), Pronsk, Soroki, Starobelsk, Sheslitamak, Svijajsk, Taganrog, Toipsé, Zadonsk and Zolsnocha. Enlargement of central stations are contemplated in the following:—Balaclava, Lipetzk, Oskol, Sorimy, Tchernigov, Tiflis, Ariev (Government of Lifland), Viatka and Vologdu.

Electric tramway installations are projected in the following places:—Bacou, Jalta, Conganek (concession), Kontais, Omsk, Orenburg, Ouman, Penza, Poltava, Samarkand (concession), Tambov, Tomsk and Varonege. Lastly, extensions of electric tramway networks are under way at Odessa, Rostov on the Don, and Vladivostok. The redemption of an electric tramway and lighting installation in Smolensk has been decided upon, to be given effect to in the course of the current year. The redemption of the tramway alone is contemplated at Tiflis. At Ivanovo-Voznessensk the building of a generating station has been begun.

The *Pyatigorsk Echo* says that the Lighting Committee of the town has signed a contract for the construction of an electric station, the work to begin this spring.

The District Government of Vladikavkaz has asked for a portion of land to be set apart for the purpose of constructing an electric station.

Coventry.—Plant Extensions.—The Electricity Committee recommends that a spare stator and spare motor be obtained for use in connection with the turbo-alternators at the electricity works, at an estimated cost of £1,658, and that certain property in Stoneleigh Terrace be purchased for the purposes of a sub-station, at a cost of £200. Both amounts are to be paid out of revenue.—*Midland Daily Telegraph.*

Dalkey.—Proposed E.L.—The Urban Council has, says the *Freeman's Journal*, been informed that the Kingstown Council, under its Electric Lighting Order, would be in a position to supply electric light to the township, and has referred the matter to a Committee for report.

Dover.—New Plant.—The town clerk has reported to the Electricity Committee that he believed that the L.G.B. was satisfied with the Corporation's application for a loan of £6,000 for new plant, and the engineer was instructed to obtain tenders as soon as the sanction was received. The estimated value (£1,000) of the sets to be superseded will have to be paid out of revenue, spread over three years. "Public service" badges are to be provided for the staff at the works.

Dublin.—The Electricity Supply Committee has purchased 20,000 pairs of carbons for the old type of city arc lamps, also supplies of various carbons for the flame arc lamps, which will keep the city lighting adequately maintained until the end of October next.

East Grinstead.—Prov. Order.—It is understood that the B. of T. will grant the application of the U.D.C. for a prov. order for E.L., but only for a date to be fixed at the end of the war.

Falkirk.—On account of the extra expenditure on coal, &c., the Corporation has increased the charges for electric current by about 30 per cent. Reference was made at a meeting of the T.C. to the fine spirit shown by firms who had contracts with the electricity department, and who had agreed without demur to pay the increased charges when they might have interpreted the contracts in the strictest sense.

Heywood.—Year's Working.—On the past year's working of the electricity undertaking there was a loss of £927, against £4,610 in the previous year. To cover this, and a loss of £1,012 on the tramways, the department has decided to ask for a sum equal to a rate of 6d. in the £.

Huddersfield.—Wages.—At a meeting of the Electricity Committee consideration was given to an application by the Municipal Employes' Association for an increase in wages of 2s. per week, and it was resolved that the Association be informed that a rise of 2s. was given to employés in January last, and that the wages of the enginemen and firers be increased ½d. per hour as from the date of the meeting. The Committee, after consideration of the electrical engineer's report as to minimum charges for energy, decided that the minimum charge for energy supplied, including meter rent, should be 10s. per half year. The Committee also resolved that for the present no alteration should be made in the charges for arc lamps.

Hull.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £27,300 for the purchase of new generating plant already installed. The Electricity Committee, owing to the stopping of capital expenditure, has decided to temporarily stop the hiring out of motors, but new services will still be connected, and the cost met out of revenue.

India.—According to the *Indian Textile Journal*, the equipment of the Karachi Electric Supply Corporation's station, which was recently opened, consists of a 100-H.P. and two 240-H.P. Mirrlees Diesel engines, coupled to Crompton dynamos, and working in conjunction with a 276-cell Tudor battery, and Crompton boosters. For balancing, two C.M.B. balancers are installed. The supply is on the three-wire system at 440-220 volts, and is given by overhead mains of stranded copper carried on steel poles. The mains work was carried out by Messrs. Henley.

Keighley.—The Morton P.C. has passed a resolution deploring the action of the Keighley R.D.C. in granting the Keighley Corporation the privilege of supplying electricity to the Morton Banks portion of the rural district, believing that such action would result in Morton Banks being absorbed into the borough. It was stated that at Morton Banks 214 of the 310 ratepayers, and in Morton 250 out of 330 ratepayers had signed a petition against the supply of electricity by the Corporation.

Kingstown.—The U.D.C. has received a report from its law agent to the effect that a deed of transfer had been executed of the Dublin and Southern District Electric Supply Co.'s rights and property in a prov. order for electric lighting, to the Kingstown U.D.C. The report stated that the company had received all moneys payable in connection therewith, except the amount claimed as arbitration costs, which would be paid when taxed.—*Freeman's Journal.*

Leeds.—Restricted Lighting.—Further restrictions of lighting have been put into operation by the authorities. Both gas and electric lighting in the streets are to be extinguished each night at 11.30, with the exception of Saturday, when the lights will be allowed to remain on until midnight. Should any hostile airships be reported as approaching the city, all lighting will be cut off, no matter what the hour may be.

London.—L.C.C.—The Finance Committee reports that from information supplied by the Woolwich B.C. with its application for sanction to the borrowing of £48,000 for its electricity undertaking, it transpires that the 650-KW. plant at the Plumstead station, of which the B.C. entered into an agreement to expedite the repayment of the outstanding debt, will be retained for use as stand-by plant. The general position appears to be that none of the older plant at the Woolwich and Plumstead stations can at present be regarded as obsolete, as the B C. is now making use of all its plant, except certain plant at Plumstead, to the amount of 450 KW., for which the boiler power is not available, and that all the older plant, both at Plumstead and Globe Lane, will more or less be "stand-by" plant when all the new plant is in working order. This being so, the Committee recommends that the acceleration of payments shall be annulled, and the original terms of repayment revived on the understanding that the outstanding debt on the plant in question shall be repaid as soon as the plant becomes obsolete.

The Highways Committee has approved agreements proposed to be entered into for a reciprocal supply of electricity between the Woolwich B C., the South Metropolitan Electric Light and Power Co., Ltd., and the West Kent Electric Co., Ltd.

The number of electric pressure stations required by the Council to be established by supply authorities is 154, and 114 are actually established. The whole of the County Council areas of supply, except the areas of the Chelsea Co. and St. Pancras B.C., where the Council's inspectors have no jurisdiction, have been dealt with.

Lewisham.—Subject to legal approval of an agreement, the B. of G. has decided to allow the South Metropolitan E.L. and P. Co. to increase its charge for current by 10 per cent. on grounds arising out of the war, this to be without prejudice to the present contract. With this increase the Board will pay less than 2¼d. per unit for current for lighting, and for power less than 1¾d.

Woolwich.—The B.C. has decided, owing to the increased cost of coal, temporarily to increase the price of energy by ¼d. per unit.

Shoreditch.—The Electricity Committee reports having received an offer from a company, which is interested in the supply of oil for fuel purposes, to carry out experiments in the burning of oil fuel in one of the boilers at Whiston Street station, and to supply, free of charge, half the quantity of oil consumed, and also to supply the necessary apparatus. The Committee has accepted the offer.

Hornsey.—In view of the L.G.B.'s order curtailing the expenditure of local governing authorities, the T.C. has inquired of the contractors supplying machinery, cable, &c., whether it is possible to stop further progress on works contracted for, and to postpone completion of the contracts for the present.

Poplar.—The report of the Electricity Committee, referred to on p. 474, recommending a reduction of electric lighting charges, and proposing a profit-sharing scheme, has been adopted by the B.C., with one amendment relating to the transfer of money to the borough fund.

Manchester.—Year's Working.—The gross income of the electricity department from all sources during the year just closed was £543,305, compared with £513,589 in the previous year. The net surplus, after meeting abnormal expenses of £12,266, war allowances to 275 employés with the Colours £6,015, additional income-tax £3,287, and Parliamentary expenses *re* Local Act £2,964, was £35,850, against £36,006 in the previous year; £30,000 is to be contributed to rate relief. In the year just commenced it is estimated that sales will increase by about 9 million units. Last year nearly 10 million more units were sold, raising the total to nearly 128 million units. In view of various factors the question of a slight revision of charges is to be considered.

Mansfield.—Camp Lighting.—The L.G.B. has informed the T.C. with reference to the Council's application for sanction to a loan of £2,000 for the provision of transforming and converting plant in connection with the electricity undertaking, for the supply of energy to the Clipstone military camp, that, in the circumstances, it has no objection to orders for the necessary plant and cables being placed at once.

Portuguese West Africa.—The British electric supply company in Angola is completing a hydro-electric plant on the Catumbella River. A 23-mile 20,000-volt transmission line will connect the new plant with the three largest towns. For current supplied to private parties the company charges 50 cents per KW.-hour for light and 11 cents for power.—*Indian Textile Journal.*

Ripon.—Loan not Sanctioned.—The Treasury has declined to approve the proposed raising of a loan of £12,000 by the Ripon Corporation for electricity works.

Rochdale.—Year's Working. — The profit on the electricity undertaking for 1914 was £1,523, against a loss of £330 in the previous year. The total receipts amounted to £33,553, against £30,471, and the working expenses were £18,279, against £20,492, leaving a gross profit of £15,274. Interest and sinking fund charges amounted to £13,751, an increase of £3,441. Capital expenditure during the year was £50,749, bringing the capital account up to £208,951. The department is asked to contribute £1,500 for rate relief.

Mill Driving.—The new mills of the Tyre Yarns, Ltd., and Fabric Weavers, Ltd., are the first cotton mills in Rochdale in which electricity is used for motive power and light throughout. Electricity is obtained from the Corporation, two new mains having been laid to the mills. When fully working the mills will take about 2,000 H.P., though this may be increased. The electricity is received at 6,000 volts and transformed to 400 volts. There are 1,500 lamps in the mills. The electrical work has been carried out by Mr. G. L. Adamson, of Ohm Works, Rochdale.

Runcorn.—At a meeting of the R.D.C. last week, it was reported that a conference had taken place at the B. of T. offices in London respecting the proposed Warrington Electric Lighting Order. An official of the Board intimated that an extension must be made by Warrington towards the parish of Latchford Without, and, further, that the terms of supply in the area of the R.D.C. should be the same as for consumers in the borough.

Selby.—E.L. Scheme.—The U.D.C. has accepted the offer of the Electrical Distribution of Yorkshire, Ltd., to give an option to purchase as a going concern the proposed works in the urban district at the end of 21 years, or, failing this, at the end of 28 or 35 years.

Walthamstow.—Loan Sanction.—The U.D.C. has received sanction to borrow £6,986 for the installation of new plant at the electricity works.

Warwickshire.—In view of the increasing use of electricity in collieries, the Warwickshire Education Committee has instructed the Mining Lecturer to report as to the probable cost of suitable electrical equipment for instruction at the Mining School.

TRAMWAY and RAILWAY NOTES.

Belfast.—Year's Working.—The annual report on the financial working of the Council's tramway system shows that the total revenue up to March 31st last was £270,237, and the working expenses £153,378, leaving a profit of £116,858. The net profit was £52,033, as compared with £51,257 in the previous year. The declaration of war seriously affected the receipts, the loss being estimated at about £21,000 since August last. The amount which was paid to war dependents was £3,058, and the number of men who had volunteered for the war was 150.

Blackpool.—Year's Working.—The income of the Corporation tramways for the past year amounted to £76,105, against £84,797 for the previous year. The total working expenses were £44,850, against £43,487 in 1913-14. Thus the gross balance was £31,255, as against the previous year's £41,310. The balance for disposal amounts to £13,737, against the previous year's £24,552. Mr. Furness (the engineer) laid before his Committee figures showing the effect of the war upon municipal tramway undertakings in 18 towns. These showed Blackpool to have suffered more than any, the decrease in receipts being 13 per cent., compared with 8 per cent. at Accrington, 5½ per cent. at Salford, 4 per cent. at Blackburn, 3½ per cent. at Birkenhead, 3 per cent. at Wigan, 2¾ per cent. at Oldham and Hull, 2½ per cent. at Warrington, 2 per cent. at Bournemouth, ½ per cent. at Brighton. &c. Three places showed increases—Newcastle-on-Tyne 12¼ per cent., Birmingham 1¾ per cent., and Sheffield 3 per cent.

Bradford.—The Tramways Committee has drawn the attention of the Street, Drainage and Works Committee to the dusty state of the streets and roads used for the railless service, and to the fact that unless the conditions could be improved there would be a suspension of the service. The latter Committee has replied that the work of improving the state of the thoroughfares concerned would be proceeded with in the ordinary way. The question which now remains is as to whether the "ordinary way" of dealing with the streets and roads will satisfy the requirements of the Tramways Committee.

Bury.—Year's Working.—The tramways last year made a net profit of £8,472, to which should be added £897, paid in respect of men on active service. The same sum as last year—£5,000—will go to the relief of the borough rate. The profit on the Radcliffe section was £318.

Canary Islands.—The concession for the electric tramway in San Cristobel de la Laguna has been awarded to the Sociedad de Tranvias Electricos de Teneriffe.—*Board of Trade Journal.*

Cardiff.—Female Conductors.—Several women started work as conductors of tramcars on Thursday last week. In two days over 200 women offered to serve.

The tramway men, at a meeting on Sunday, passed resolutions protesting against the employment of females as conductors, declaring that plenty of males ineligible for military service were available.

Continental.—Switzerland.—The Swiss Federal Railways Administration has decided to construct a hydro-electric station at Massaboden, near Brigue, to supply current for the working of the Simplon line. The new station will replace the provisional station built at the northern entrance of the tunnel. The equipment will comprise two 5,500-H.P. Piccard and Picket turbines, running at 500 R.P.M., under a fall of 43 metres, with automatic regulators and other modern accessories.

East Ham.—The engineer and manager of the Corporation tramway department has drawn up a report on the rolling stock at his disposal, showing the necessity for modernising the equipment of the existing cars, in order to reduce the present excessive maintenance, and the purchase of additional cars in order to cope with traffic requirements. The Tramways Committee recommends that, as an experiment, one of the cars be fitted with a new type of equipment with 40-H.P. motors and new controllers, at a cost of £275. The question of the purchase of additional cars has been deferred.

Glasgow.—The special Sub-Committee of the Tramways on depreciation has had before it an abstract statement of the revenue and expenditure for the year to May 31st, 1914, showing a surplus of £53,892, with estimated figures for the year to May 31st, 1915, showing an estimated deficit of £31,017, and has agreed to recommend that allowances for depreciation be made in the accounts for the current financial year, as undernoted:—

	Year to May 31st, 1914.	Year to May 31st, 1915.
Permanent way	£440 per mile	£350 per mile
Elec. equipment of line ...	Av., 4·3 p.c.	Av., 2·9 p.c.
Buildings and fixtures ...	2½ „	2½ „
Power plant...	7·1 „	5 „
Workshop plant	7½ „	5 „
Cars	Av., 9½ „	Av., 8·2 „
Elec. equipment of cars ...	7½ „	6 „
Other rolling stock... ...	Av., 16·4 „	Av., 16·4 „
Misc. equipment	7½ „	5 „

The Sub-Committee on Finance has continued consideration of the report, as also a suggestion that a sum of £20,000 be taken from the reserve fund—which amounts to £38,069—and paid over to the common good fund of the city. The following information was also submitted:—Capital expenditure as at May 31st, 1914, £3,675,317 0s. 8d.; total amount at credit of renewals and depreciation as at May 31st, 1914, £2,158,738 18s. 6d.; amount set aside to meet renewals and depreciation for year to May 31st, 1914, £212,642 3s. 8d.; amount proposed for renewals and depreciation for year to May 31st, 1915, at suggested rates, £172,282 16s. 3d.; proposed reduction in renewals and depreciation for year to May 31st, 1915, £40,359 7s. 5d.

War Expenses.—A return, showing the extra expenditure incurred by the tramway department up to April 10th as a result of the war, has been prepared by the general manager. The total expenditure was £35,384, apportioned as follows:—Allowances to dependants, £30,360; car tokens to military and special constables, £4,308; special car, £241; pipe bands and drums for 15th Highland Light Infantry, £300; use of flare lamps, &c, £173. It is estimated that the total expenditure under the above headings to the end of the financial year on May 31st will amount to about £45,000.

The tramway system was brought to a complete stoppage for a short time on Thursday last week, through a workman having driven his pick into a high-tension cable near Parkston power station.

Huddersfield.—The T.C. has decided that the time is not now opportune for consideration of the extension of the tramway system to Lepton and Kirkheaton. The Committee has decided that a war bonus be paid in accordance with the resolution of the Council, based on the men's actual earnings per week as taken from the wage book, and that time and a quarter be paid to the spare men after 5 p.m. on Saturdays after they have worked eight hours.

Leeds.—War Bonuses.—The tramway men have considered the offer of the authorities in respect of the payment of a war bonus, and have written expressing the view that the concessions offered are insufficient. The men state that the grant only amounts, in the majority of cases, to 1s. a week.

London.—L.C.C. Tramway Receipts.—The total traffic receipts for the year ended March 31st, 1915, were £2,323,053 from lines worked by electric traction, and £10,261 from lines worked by horse traction, a total of £2,333,314. The receipts for the previous year under the same heads were £2,181,344, £21,146 and £2,202,490 respectively. The total car-miles run were 52,224,529, and the number of passengers carried 534,793,356. During the year ended December 31st, 1913, the number of fatal accidents caused by the working of the electric tramways was 37, while the number during 1914 was 25; during last year Sunday was the day on which most fatal accidents occurred, the number on this day was 6, or nearly 25 per cent. of the total.

The Highways Committee reports that the London Electric Supply Corporation has intimated that owing to the considerable increase in the price of coal and labour it will be compelled to raise its price for power supplied to the tramways. The Committee has agreed that as from March 3rd, 1915, the rate to be paid by the Council shall be 4d. a unit plus £3 a KW. per year for power supplied, but if only a stand-by supply is required, the charge is to be at the rate of £2 a KW. a year.

Manchester.—A meeting of the tramway workers has passed a resolution calling on the Tramway Committee to grant increased wages to all employés receiving up to 40s. per week, instead of the present limit of under 30s. per week.

Newcastle-on-Tyne.—Extensions Deferred.—The Longbenton U.D.C. has consented to the postponement of construction of the tramway from the city boundary to Longbenton, authorised by the Corporation Act of 1914, as a result of representations by the B. of T.

With reference to the differences between the T.C. and tramwaymen in regard to wages, it is understood that the matter may be referred to arbitration.

Rawtenstall.—Halfpenny Fares.—As an experiment halfpenny fares are to be charged on the Water section of the tramway from Monday to Friday in each week. The experiment will be tried for three months.

Rochdale.—Year's Working.—The working of the Corporation tramways last year, resulted in a net surplus of £4,284, which is £4,205 less than a year ago and £3,939 less than two years ago. The fall is due mainly to extra repairs to permanent way and cars, increased wages, increased income-tax, current, and allowances to men on active service. Total traffic revenue amounted to £83,401, and working expenses to £46,891. The Committee has asked that the surplus of £4,284 should go to reserve and renewals account in view of the heavy commitments that face the department.

Salford.—The *Manchester Evening News* recently stated that, owing to the war, the Corporation tramway undertaking is being worked at a heavy loss, and that in order to increase the revenue it is proposed to abolish workmen's tickets and to withdraw concessions granted to the travelling public a year ago—concessions in the shape of extensions of stages.

South Africa.—Electric Vehicles.—The State Railway authorities have lately taken delivery of a fleet of nine electric motor-lorries, constructed by the General Vehicle Co., of New York; the vehicles are being used in the Cape Town district.

Southport.—The number of men from the tramway department who have enlisted is 34 out of 88. One clerk, nine conductors and one motorman left to join the army on Saturday.

Wigan.—War Bonuses.—By a majority of nearly two to one, Wigan tramway men have declined to accept the Coporation's war bonus offer of 2s. per head to men earning less than 35s. a week. The result of the ballot will be communicated to the Tramways Committee.

York.—The Special Committee that has been considering the works involving capital expenditure which could be held over till after the war, has decided that the Hull Road tramways extension and the extension of the electric mains to Strensall, Poppleton, and Naburn, and the provision of cooling-tanks at the electricity works, are essential, and their abandonment would involve the city in heavy financial loss.

TELEGRAPH and TELEPHONE NOTES.

Hong-Kong.—The American Consul reports that the expert from England who is to superintend the erection of the wireless installation arrived in Hong-Kong early this year. The proposed range has been increased to 500-700 miles by day and 1,300 miles or more by night under normal conditions, and the plant is expected to be in operation within five months. The inauguration of this service has some additional importance in view of the fact that the large wireless stations of the Chinese Government at Canton and Woosung, near Shanghai, are now working, and those at Foochow and Hankow will be completed by the time the Hong-Kong station is in working order. The service of the two Chinese stations now ready was commenced at the beginning of the year. They cover substantially the same radius as the Hong-Kong station, the plants thus being able to exchange messages with each other as well as with all ships in Chinese waters. A typhoon warning service was one of the first features adopted by the new system.

All these coast stations are of the same construction. The oscillating power in the antennæ is 5 kw. The stations are manned by a Chinese staff trained by foreign experts in the Peking College of Communications. The Woosung station has been opened for day and night service, and the Canton station is open from 8 a.m. to 10 p.m. The stations are supervised by managers with six to eight years' practical experience in wireless work. The charges are 5d. per word, with a minimum per telegram of 4s. 2d.

Illicit Wireless Apparatus.—William Thompson, described as a labourer, was charged with having in his possession wireless telegraph apparatus without the consent of the Postmaster-General at Blyth, on the 25th inst. A Post Office expert said that the apparatus could transmit messages over a radius of 5 miles under favourable circumstances. The defendant stated that he had made electrical experiments a hobby. He was not using the apparatus as a wireless telegraph instrument; the major part was used in developing the idea of steering ships at sea from the shore. He was experimenting on this subject with a model yacht on Ridley Park lake. A second charge of stealing 26 lb. of brass was also preferred against Thompson. The defendant had taken the brass to help him in his electrical experiments. The defendant was sent to prison for six months in the second division on the first charge and for one month on the second charge, also in the second division, the terms to run concurrently.—*Morning Post.*

Libya.—The American Consul at Tripoli reports that under the Ottoman *régime* land telegraphs were considerably developed in what is now the Italian Colony of Libya, 3,150 miles of wire being in existence at the end of 1910. During the war practically the entire telegraph system was destroyed, but there is now a permanent system, extending along the coast for more than 370 miles, and inland over a zone about 55 miles wide, with a total length of 870 miles of wire, with 24 telegraph and six telephone stations. Tripoli, the metropolis of the Colony, is still without telephonic communication for civil purposes. Some months ago several private firms applied to the Minister of the Colonies for a concession to install and operate a system, and on September 30th, 1914, a Commission appointed from Rome was charged with examining the question, but no pronouncement as to its findings has been made public. A system is maintained for Government needs. Before the Italian advent there was no wireless equipment in this district, but after they landed 12 installations were set up to replace the dismantled telegraphs. The instruments are Marconi, and the type most used is the 1·5-kw. musical spark station, which, designed for car transport, has been adapted for carriage by camel. Eventually all the telegraph lines destroyed will be rebuilt and others provided, but, being State owned and entirely constructed by State engineers, supplies will not be purchased locally but requisitioned through Rome. Firms interested in such articles who desire to enter this field should have agents in Italy in a position to interest officials charged with the purchase of telegraphic materials.

Russia.—Since the opening of the war the number of applicants for fresh telephones in Petrograd has fallen away by 50 per cent., and over 900 apparatus have been taken away from old subscribers.

Telephone Repeaters.—Writing to the *Electrical World*, the President of the De Forest Radio Telephone and Telegraph Co. states that the trans-Continental telephone system, New York—San Francisco, was made possible by the use of the De Forest "Audion" amplifier as a telephone relay. There are three audion repeater stations in the line.

The *Telegraph and Telephone Age* states that the De Forest Co. has recently developed an audion amplifier or audiphone, which is designed to relay or amplify minute pulsating or alternating electrical impulses from five times to 600 times their original intensity, without lag or distortion. It is stated that the wire telephone and telegraph rights have been acquired by the American Telephone and Telegraph Co.

The Telegraph Service.—At a special Conference of the Telegraphs Section of the Postal and Telegraph Clerks' Association, at Birmingham, on the 23rd inst., to consider the possible effects of the introduction of machine telegraphy, a resolution was adopted declaring that the introduction of typists and other telegraphically unskilled persons in any of the operations of telegraphic communication was an infringement of Trade Union principles. Another resolution was carried suggesting that it should be reported to the Parliamentary Committee of the Trade Union Congress that the Department was taking advantage of the war situation to employ typists at low wages on work hitherto done by telegraphists.

The Government has declined to grant a war bonus to postal employés with salaries below £210 per annum, having decided that the rise in the cost of living is not by itself a sufficient reason, at the present time, for increasing the wages of the employés.

United States.—New York.—The New York Telephone Co. has accepted an order of the Public Service Commission reducing the telephone tariff throughout the city; the new rates will come into force on July 1st, and are estimated to save the public $2 700,000 a year. The minimum charge for business and residence telephones will be 5 cents a call; and the cost of calls will depend upon the distance between the stations, the city being divided into 10 zones.

It is reported that the Telefunken wireless station at Sayville, Long Island, is being increased in power from 35 to 100 kw., so that communication can be continually maintained with Nauen in Germany.

San Francisco Exposition.—When President Wilson opened the Panama-Pacific Exposition by closing an electric circuit at the White House on February 20th, the signal was carried over a telegraph wire to the radio station at Tuckerton, N.J., which is operated by the United States Navy department. At Tuckerton the signal automatically operated a relay which set electric waves into action and the wireless signal was instantly received at the Tower of Jewels on the fair grounds at San Francisco, causing another relay to operate. The latter relay closed circuits throughout the grounds, and on receipt of the signal the main door of the Machinery Hall was opened, and the "Fountain of Energy" at once began to play. The wireless apparatus employed was that of the Federal Telegraph Co., of San Francisco, which uses the Poulsen system.—*Telegraph and Telephone Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—May 4th. Steam and other pipework; water-softening plant. See "Official Notices" March 26th.

Australia.—Melbourne.—May 18th. Four 250-k.v.a. three-phase transformers; 9,680 yards ·05 sq. in., three-core, lead-covered cable, for the City Council. See "Official Notices" to-day.

May 19th. Victorian Railways. Meters, coasting recorders or other energy-checking devices for train operation on the multiple-unit system, D.C., 1,500 v. See "Official Notices" to-day.

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

Sydney.—June 16th. Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

July 19th. Municipal Council. One or two 12,000-kw. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Halifax.—May 7th. Coal for a year, for the Corporation Electricity Works (10,000 tons of pea slack or screenings, 5,000 tons of washed peas or washed smalls, 5,000 tons of small nuts). Mr. W. M. Rogerson, Borough Electrical Engineer (returnable deposit of £5).

Leigh (Lancs.).—May 21st. One vertical tube boiler, one 250-kw. rotary converter or motor converter, one switch panel, for the Borough Electricity Committee. See "Official Notices" to-day.

London.—May 12th. L.C.C. Installation, about 210 wiring and 250 lighting points, at Sebbon Street Elementary School, Islington, N. See "Official Notices" to-day.

South Africa.—Johannesburg.—June 1st. Municipal Council. 24 double-pole, automatic, oil-immersed circuit breakers of a continuous carrying capacity of 200 amperes (Contract No. 971). Specifications, &c., from the Controller of Stores, Municipal Offices, Plein Square, Johannesburg. Tenders to Town Clerk.—*Board of Trade Journal.*

Spain.—The municipal authorities of Canizal (Province of Zamora) have lately invited tenders for the concession for the electric lighting of the town during a period of 10 years.

The time for submitting proposals for a railway, electrical or otherwise, from Madrid to Valencia has been extended to 18 months from February 21st.

Tasmania.— Launceston.— July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Winchester.—May 11th. Corporation. Twelve months' supply of steam coal, for the Electricity Department. See "Official Notices" to-day.

CLOSED.

Croydon.—The Council, on Monday, accepted the tender of Messrs. Green & Son (£831) for a new economiser for the electricity works, with 384 tubes and damper gear.

East Ham.—The tenders of Messrs. E. Broderick & Co., Ltd., Messrs. S. Pearl & Co. and the East Ham Rubber Co. have been accepted by the T.C. for a 12 months' supply of uniforms to the tramways department; as have also the tenders of Messrs. Farmer & Co., Pryke & Palmer, Engineering Supplies, Ltd., Middleton Bros., M. G. Davis & Co. and Docker Bros. for supplies of engineers' sundries to the electric lighting and tramways departments.

Glasgow.—Messrs. Woodward & Co. have secured the contract for the supply of six months' carbons to the Cleansing Committee of the T.C.

The T.C.'s Tramways Committee has accepted the offer of the British Thomson-Houston Co., Ltd., for switchgear for Kinning Park sub-station.

Huddersfield.—The Tramways Committee has accepted tenders for stores as follows:—

Brake blocks and castings.—France & Brook, Slaithwaite, and Melton and Co., Halifax.
Cables.—W. T. Glover & Co.
Steel tramcar tires.—J. Brown & Co.

London.—L.C.C.—The Stores and Contracts Committee has accepted the following tenders during the three months ended March 31st, 1915:—

Electric lamps, Schedule No. 17.—Edison & Swan U.E.L. Co.—Items 8 to 27 (metallic-filament lamps, drawn wire).
Electric traction glow lamps for Tramways Department (Schedule No. 17*a*).—Siemens Bros. Dynamo Works, Ltd.—Item 1 (standard Dutch type).

The Highways Committee has received the following tenders for the supply of rails for the construction, reconstruction and maintenance of the Council's tramways:—

Track Rails and Fastenings.

Walter Scott, Ltd. .. .. (accepted)	£28,340
Bolckow, Vaughan & Co., Ltd.	29,675
Chief Engineer's estimate	£26,580

Conductor Rails.

Frodingham Iron and Steel Co., Ltd. .. (accepted)	£17,150
Chief Engineer's estimate	£15,650

The following tenders were received for the provision of two 8,000-KW. turbo-generators for the Greenwich generating station:—

Cole, Marchant & Morley, Ltd. .. .. (incomplete)	£15,313
Brit. Thomson-Houston Co., Ltd. .. (incomp'ete)	51,070
J. Howden & Co., Ltd. .. .. .. (incomplete)	55.161
Do. .. .. (alternative do.)	56,720
Maschinenfabrik Oerlikon	57,600
Fraser & Chalmers, Ltd.	58,012
Do. .. .. (alternative)	59,709
Brit. Westinghouse Elec. & Mfg. Co., Ltd. .. (accepted)	62,008
Fraser & Chalmers, Ltd. .. .. .. (alternative)	63,816
Escher, Wyss & Co.	64,016
Willans & Robinson, Ltd.	64,620
Do. .. .. (alternative)	65,619
Escher, Wyss & Co .. .. (alternative)	66,795
Brush Elec. Eng. Co., Ltd.	67,064
Do. .. .. (alternative)	67,442
Dick, Kerr & Co., Ltd.	68,100
Estimate of Chief Officer of Tramways	£54.532

The Committee reports that the lowest complete tender was that submitted by Maschinenfabrik Oerlikon of Switzerland, but in view of the difficulties which would be likely to arise in the transport of raw materials and of the completed work, and in the inspection of the machinery during manufacture, it was decided to pass over this tender. With regard to the tenders submitted by Fraser & Chalmers, Ltd., the Committee was advised by Sir A. B. W. Kennedy, the electrical engineer, retained by the Council to advise on the tenders, that, although they were a firm of the highest standing, they had not constructed any turbines of a larger capacity than 3,000 KW. In view of the fact that the early delivery and smooth and speedy operation of these machines were of the utmost importance for the safe working of the undertaking, it was necessary to take into serious consideration the experience which the different firms tendering had had of machines of the type and size in question. The next lowest tender was that of the British Westinghouse Co., who had supplied three of the five turbo-generators at the generating station, and had since completed a further machine for the station, and acting on the advice of Sir A. Kennedy, the tender of the latter firm was accepted.

The following tenders have been received for the supply and laying of cables required in connection with an additional supply of power up to 3,500 KW., to be obtained from the London Electric Supply Corporation in connection with the working of the Council's tramways.

Western Electric Co., Ltd. .. .. .. (accepted)	£6,214
British Insulated & Helsby Cables, Ltd.	6,298
W. T. Henley's Telegraph Works, Ltd.	6,408
Johnson & Phillips, Ltd.	6,636
W. T. Glover & Co., Ltd.	6,743
Siemens Bros. & Co., Ltd.	6.799
Callender's Cable and Construction Co., Ltd.	6 833
Estimate of Chief Officer of Tramways	6,214

The undermentioned tenders were received for 20,245 yards of trolley wire. The two lowest tenders were for goods made abroad, and in view of the transport difficulties were passed over.

Edward le Bas & Co.	£62 10 per ton
Fernand Espir	66 10 ,,
F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.) (accepted)	65 19 6 ,,
B.I. & Helsby Cables, Ltd.	68 5 ,,
Watlington & Co., Ltd.	68 0 ,,
T. Bolton & Sons, Ltd.	68 5 ,,

For 3,000 driving and 2,000 trailing wheel tires for the Council's tramcars, or, alternatively, 6,000 driving and 4,000 trailing wheel tires, the following tenders were received per tire:—

	3,000 driving wheel tires.	2,000 trailing wheel tires.	6,000 driving wheel tires.	4,000 trailing wheel tires.
John Brown & Co., Ltd. (accepted)	£1 6 6	£1 6 6	£1 6 0	£1 6 0
H. Bessemer & Co., Ltd.	1 10 6	1 5 0	1 10 6	1 5 0
Cammell, Laird & Co., Ltd.	1 18 0	1 11 0	—	—
Brown, Bayley's Steel Works, Ltd.	1 17 6	1 10 0	1 17 6	1 10 0
Steel, Peech & Tozer, Ltd.	1 18 7	1 11 11	—	—
Vickers, Ltd.	2 0 0	1 10 0	2 0 0	1 10 0
Patent Shaft and Axletree Co., Ltd.	1 18 0	1 15 0	1 18 0	1 15 0

Baldwin Locomotive Works, (Standard Steel Works Co.)	£12,134 / £14,268

(Plus cost of freightage from New York.

The Committee recommends that, in view of the conditions that arise owing to the war, the operation of Standing Order No. 295 be suspended, and that payment be made to Messrs. Dick, Kerr & Co., Ltd., the contractors for the supply of rotary converters for tramway sub-stations, at the rate of 50 per cent. of the value of the work executed and completed, whether such work had been delivered or not. Also that the operation of the Order be suspended, in order that payment on account of £8,000 may be authorised to the British Westinghouse Electric and Manufacturing Co., Ltd., in respect of further work completed by the company under its contract for the provision of two 8,000-KW. steam turbo-generators for the Greenwich generating station, but of which the Council is unable to accept delivery, the foundations not being ready.

The undermentioned tenders were received for rolled steel bar for magnetic brake shoes:—

	500 tons for 25A magnets. Per ton.	120 tons for 25A magnets. Per ton.
Lilleshall Co., Ltd. .. .. .. (accepted)	£8 10 0	£8 10 0
Frodingham Iron and Steel Co., Ltd.	8 16 3	8 16 3
Earl of Dudley's Round Oak Works, Ltd. ..	8 17 6	9 10 0
H. Bessemer & Co., Ltd.	9 7 6	9 7 6
Goodwin & Co.	14 10 0	14 10 0

The Committee has accepted the offer of the London Electric Wire Co. and Smiths, Ltd., for 2 tons of triple cotton-covered copper wire, in excess of the amount contracted for, at the price of £79 a ton (£4 a ton below the contract price).

The undermentioned tenders for the supply, during 1915-16, of tramways equipment have been accepted:—

Electrical Equipment (Motor Generator) Spares.

British Westinghouse Co., items 1 to 17 inclusive and 23.
Dick, Kerr & Co., Ltd., items 19 to 22 inclusive, and 25 to 29 inclusive.
A. Clare & Co., items 18, 24 and 31.
Manchester Armature Repair Co., item 30.

Electrical Equipment (Controller, Circuit Breaker and other Switch, &c., Details, and Magnetic Brake) Spares.

British Westinghouse Co., items 1 to 21 inclusive, and 24 to 45 inclusive.
Dick, Kerr & Co., Ltd., items 22 and 23.

Contact Fingers and Parts, Segments, &c.

British Westinghouse Co., items 1, 12, 19, 31, 32, 36 and 38.
Dick, Kerr & Co., Ltd., item 47.
Dyer & Young, items 21, 26, 27, 33, 34, 35, 45, 50 and 52.
E. Showell & Sons, Ltd., items 2, 6, 20, 22, 25, 29, 30, 37, 43, 46, 49 and 54.
Tramway Supplies, Ltd., items 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 23, 24, 39, 40, 48, 51 and 53.

Electric Cable, Fuse Wire and Cotton-Covered Copper Wire.

B.I. & Helsby Cables, Ltd., item 3.
Hooper's Teleg. and I.R. Rubber Works, Ltd., item 4.
Liverpool Electric Cable Co., Ltd., item 2.
Midland Electric Wire Co., Ltd., item 1.
Saxonia Electrical Wire Co., item 5.

Copper Bonds.

B.I. & Helsby Cables, Ltd., items 1 (*a*) and (*b*).

Moulded Insulators (other than Rubber).

British Westinghouse Co., items 4, 5, 7 and 10.
Crystalate Mfg. Co., item 17.
Ebonestos Mfg. Co., items 1, 2, 3, 21 to 24 inclusive.
Litholite, Ltd., items 6, 8, 9, 11 to 16 inclusive, 18 to 20 inclusive, and 25.

Mica and Micanite Articles.

G. Schultz & Co., Ltd., item 1.

Track Insulators.

Bullers, Ltd., items 1 and 2.
Gaskell & Grocott, Ltd., item 3.
Doulton & Co., Ltd., item 4 (half the estimated quantity).
Taylor, Tunnicliff & Co., Ltd., item 4 (half the estimated quantity).

Brake Shoes.

Pease & Partners, Ltd., items 1 to 8 inclusive.

The Fire Brigade Committee received the following tenders for the supply of a motor-lorry for use by the Fire Brigade :—

Dennis, Bros. (1913), Ltd.	£650
Belsize Motors, Ltd.	675
London Motor Exchange	675
W. A. Stevens, Ltd. (accepted)	764
Clayton & Co. (Huddersfie'd), Ltd.	765
Leyland Motors (1914), Ltd.	765
Albion Motor-Car Co., Ltd.	770
The Daimler Co, Ltd.	792
The McCurd Lorry Mfg. Co., Ltd.	800

Owing to the demands being made upon them by the military authorities, the two lowest tenderers were unable to specify the dates by which they would be in a position to effect delivery, and the Committee was advised that the lorry offered by the third lowest tenderers would not be suitable for the purposes of the brigade. In these circumstances the next lowest tender, amounting to £764, of W. A. Stevens, Ltd., which was for the supply of a lorry propelled on the petrol-electric system, was accepted.

The Committee has accepted the offer of the Crypto Electrical Co. of £58 for the supply of motor-generators and instruments for the electric charging apparatus at the Belsize, Bow and Red-cross Street stations.

The Stores and Contract Committee states, in continuation of the report of January 26th, 1915, that as the result of inquiry in a number of cases, it has decided to have no more dealings with eight further firms controlled wholly or largely by enemy aliens, and their names have been removed from any lists on which their names appear of firms to be invited to tender for the supply of stores, &c.

For the reconstruction of portions of the electric goods lift at the Ray Street stores premises, the following tenders have been received :—

Spagnoletti, Ltd. (Park Royal Engineering Works, Ltd.)	£148
Ditto alternative (accepted)	140
A. W. Penrose & Co., Ltd., 109, Farringdon Road, E.C.	172
Easton Lift Co., Ltd.	188
Ditto alternatives	170 & 196
Waygood Otis, Ltd.	195

Chief engineer's estimate, £105.

Stepney.—The Electricity Committee of the B.C. reports the purchase of 1,440 tons of coal for the electricity undertaking in lots of 10 to 750 tons at prices ranging from 21s. to 26s. per ton.

Battersea.—The Electricity Committee recommends the acceptance of the following annual tenders :—

Prices, Ltd.—Oils, with the exception of turbine oil.
Duckham, A., & Co.—Turbine oil.
Pryke & Palmer.—Engine-room stores, ironmongery, &c.
Beldam & Co.—Packings.
British Insulated Co., Ltd.—Consumers' fuse boxes.
Dussek & Co.—Box compound.
Callender's Cable & Construction Co., Ltd.—Troughing, bridges, bitumen, &c.
Reason Manufacturing Co., Ltd.—Electrolytic meters.
British Thomson-Houston Co., Ltd.—Carbon lamps.

Poplar.—The following tenders have been received by the Borough Council for the supply of two 1,000-kw. converters to be erected at the main station and Glengall Road sub-station :—

Siemens Bros. (Ferranti transformer, 750 R.P.M.)	£1,850
Alternative (Brush transformer, 750 R.P.M.)	1,898
General Electric Co., Ltd. (Ferranti, 500 R.P.M.)	1,900
Alternative (Brush, 500 R.P.M.)	1,925
British Thomson-Houston Co. (Brush, 500 R.P.M.)	1,990
First alternative (Brit. Electric, 500 R.P.M.)	2,117
Second alternative (Westinghouse, 500 R.P.M.)	2,122
British Westinghouse Co. (Westinghouse, 500 R.P.M.)	2,013
Bruce Peebles & Co. (Westinghouse, A 375 R.P.M.)	2,265
First alternative (,, C 375 R.P.M.)	2,285
Second alternative (,, G 428 R.P.M.)	2,180
Third alternative (,, E 428 R.P.M.)	2,150

The engineer recommends the acceptance of the tender of the General Electric Co., for one rotary converter with Brush transformer for £1,925. As regards the Glengall sub-station, the engineer points out that the building is not suitable for rotary machines, and that it is desirable to install a motor converter which will be in line with the existing machines. He recommends the installation of Messrs. Bruce Peebles & Co.'s type A, for £2,265. The Committee has adopted the engineer's recommendations.

The following tenders have also been received, for renewing the electric lighting and heating circuits at the Council Offices, and the substitution of five 1,000-c.p. half-watt lamps in the Council Chamber :—

H. E. Keen & Co. (accepted)	£135
Duncan Watson & Co.	185
Marler & Co.	218

Woolwich.—The tender of Messrs. Babcock & Wilcox, Ltd., at £256, for steam piping, has been accepted by the Electricity Committee. The tender of Messrs. Seagers, Ltd., has been accepted, at £260, for a cast-iron rain-water tank required in connection with the Globe Lane extensions.

Meter Contracts.—The Electrical Apparatus Co., Ltd., have secured the following contracts :—

Cheltenham Corporation.—Single-phase meters, for 12 months.
Bray U.D.C.—Single-phase meters, for 12 months.

Messrs. Chamberlain & Hookham, Ltd., have received contracts for the supply of meters to Cardiff, Grimsby and Hornsey.

Thanet.—The Joint Hospital Board has accepted the tender of Mr. Pinto, of Ramsgate, for the maintenance of the electric bells and private telephones at the hospital.

Walthamstow.—The following tenders have been accepted by the District Council for annual supplies of electricity and tramway stores :—

W. T. Henley's Telegraph Works Co.—Cables and pure rubber tape.
General Electric Co.—Steel conduits and saddles.
Edison & Swan United Electric Light Co.—Ceiling roses, lampholders, &c.
Chamberlain & Hookham.—Meters.
General Electric Co. and Cryselco, Ltd.—Carbon-filament lamps.
Geo. Angus & Co.—Rubber insertion and packing.

The following tenders are recommended for acceptance for the supply of switchgear and cables :—

British Thomson-Houston Co.—High-tension switchgear, £391.
General Electric Co.—Low-tension switchgear, £230.
W. T. Henley's Telegraph Works Co.—Cables. Price not mentioned.

The Lighting Committee has purchased 200 tons of Shirebrook nutty slack outside contract from Hincheliffe & Co., at 18s. 10d. per ton.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 30th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. Lecture on "The Modern Aeroplane," by Dr. R. T. Glazebrook, F.R.S.

(Graduates' Section.)—Saturday, May 1st. At 7.15 p.m. Discussion on "The Making and Filing of Engineering Notes," opened by Mr. C. Ian Burrell.

Royal Institution of Great Britain.—Saturday, May 1st. At 3 p.m. At Albemarle Street, W. Lecture (I) on "Photo-Electricity," by Prof. J. A. Fleming, F.R.S. At 5 p.m. Annual Meeting.

Monday, May 3rd. At 5 p.m. General meeting.

Thursday, May 6th. At 3 p.m. Lecture (II) on "Advances in General Physics," by Dr. A. W. Porter, F.R.S.

Friday, May 7th. At 9 p.m. Paper on "Electrons and Heat," by Prof. O. W. Richardson, F.R.S.

Saturday, May 8th. At 3 p.m. Lecture (II) on "Photo-Electricity," by Prof. J. A. Fleming, F.R.S.

Institution of Electrical Engineers (Students' Section).—Wednesday, May 5th. At 7.30 p.m. At Victoria Embankment, W.C. Annual General Meeting.

(Newcastle Local Section).—Monday, May 3rd. At 7.30 p.m. At the Mining Institute. Paper on "Phantom Circuits in Telephony," by Mr. A. W. Martin.

Salford Technical and Engineering Association.—Wednesday, May 5th. Visit to Gresley Iron Works, Salford.

Junior Institution of Engineers.—Friday, May 7th. At 8 p.m. At 39, Victoria Street, S.W. Informal discussion.

Association of Mining Electrical Engineers (Notts. and Derbyshire Branch).—Joint Meeting with National Association of Colliery Managers. Saturday, May 8th. At 3.30 p.m. At University College, Nottingham. Paper on "Protective Devices," by Messrs. E. Kilburn Scott and L. F. Fogarty.

NOTES.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the April meeting of the Association, a standard policy for insurance at Lloyd's against breakdown, which had been considered at several meetings of the Committee, was approved and adopted. This insurance includes specially advantageous terms to members of the Association, and arrangements have been made for periodic inspections of the plant, and for advice and full reports to be furnished by fully-qualified Diesel engine experts acting for the underwriters. Until this standard form was framed, no form of policy specially applicable to the Diesel engine had been in use. The forms and conditions generally used were those applicable to a gas engine, and consequently difficulties arose in the interpretation. It is hoped that the immediate offer of specially advantageous terms will lead to insurance of this plant being more generally effected, and in that case the larger volume of business done should result in still more favourable rates for insurance being obtainable within a short time.

A discussion on the lubrication of Diesel engines was opened by Mr. H. L. Alderton, of Guildford, who dealt with the various methods of lubrication by means of ring lubricators, ordinary drip, or forced feed with pumps or centrifugal rings. Mr. Alderton emphasised the importance of carefully selecting the best oil for cylinder lubrication so as to avoid troubles from carbonisation and gumming. He said that apparently large engines required more oil in proportion to their output than the smaller engines. In the discussion it was shown that in some cases one class of oil was used throughout the engine, and in others different oils for the bearings, cylinders and compressors. The methods of filtration of oil, and the extent to which filtration was carried out, also showed a considerable amount of variation. It was decided to ask for returns from the various members of the Association giving information as to the methods of lubrication, with quantities and costs, in connection with their plants, with a view to a further discussion on the subject.

The next meeting of the Association is to be held on Wednesday, May 19th. Information and particulars concerning the Association can be obtained from the acting hon. secretary, Mr. Percy Still, at 19, Cadogan Gardens, London, S.W.

We understand that the special Diesel engine policy referred to in the above report has been drawn up by Messrs. Banks, Warner

and Co., of 11, Queen Victoria Street, E.C., who have retained as their inspecting engineers the well-known Diesel experts, Mr. Phillip N. Smith and L. W. Johnson.

Institution of Electrical Engineers.—The fifteenth annual general meeting of the Manchester Local Section was held on Tuesday evening, the 27th inst. The chairman (Mr. P. P. Wheelwright) presided. The annual report was read and approved; the membership was 732, a considerable decrease on last year's figures. The voting for the officers and Committee resulted as follows, viz.:—

Chairman—Mr. B. Welbourn.

Vice Chairmen—Messrs. C. J. Beaver and A. E. McKenzie.

Hon. Sec. and Treasurer—Mr. Julius Frith.

Committee—Prof. A. B. Field; Messrs. H. Allcock, C. C. Atchison, A. P. M. Fleming, W. Cramp, S. L. Pearce, J. S. Peck, H. D. Symonds, H. A. Ratcliff, J. A. Robertson, S. J. Watson and Mr. Alderman Walker.

Votes of thanks were accorded to the chairman and hon. secretary for their services during the year, also to the Committee of the Engineers' Club for allowing the use of the room for holding the meetings. At the conclusion of the meeting, Mr. A. Dickinson's paper on the Bombay hydro-electric scheme was read by Mr. E. S. W. Moore, in the unavoidable absence of Mr. Dickinson owing to indisposition.

Association of Electrical Station Engineers.—A meeting representative of the station and mains engineers of Greater London was held under the auspices of the A.E.S.E. London Branch, on April 27th, at Stone's Restaurant, Ludgate Hill, E.C. Two letters which had been received by the A.E.S.E. Committee were brought forward for the consideration of the meeting: One from the Electrical Trades Union London District Committee, inviting the A.E.S.E. London Committee to a conference "To consider if steps can be taken to secure an advance of wages in view of the abnormal circumstances now prevailing"; the other from the Associated Municipal Electrical Engineers (Greater London), which asked for two or three dates when it would be convenient for the proposed conference. This conference was originally asked for by the A.E.S.E., on February 9th, 1914, but had not been held owing to a difficulty in finding convenient dates.

After a lengthy discussion, the meeting unanimously agreed that the London Committee should meet both organisations in conference with the ultimate object of an increase in wages.

Institution of Civil Engineers.—The Council has made the following awards for papers read and discussed during the session 1914-15:—The Telford Gold Medal to Mr. A. L. Bell (Rosyth); Telford Premiums to Mr. C. W. Anderson (Chakradharpur, India); Sir Thomas Mason (Glasgow); Dr. H. F. Parshall (London); and Mr. H. E. Yerbury (Sheffield); and the Crampton Prize to Mr. F. D. Evans (Kuala Lumpur, F.M.S.). The awards for papers to be published in the *Proceedings* without discussion will be announced later.

Electric-Light Switching Competition.—Those who are interested in the use of special tumbler switches for the control of glow-lamp and other consumption circuits, and who wish to improve and afterwards test their knowledge of the subject, would be well advised to consult the issues of our contemporary *Electricity* during the month of May. This journal is holding the next of the competitions organised by Messrs. A. P. Lundberg & Sons, which have now become a regular feature of the electrical year; money and book prizes and certificates will be awarded to successful competitors. The subject of electric light switching is well worth investigation on the part of all who are in any way concerned with lighting installations.

Wireless Control of Public Clocks.—Writing on the subject of Mr. Ball's suggestion to check the performance of public clocks by wireless reports, in the *Horological Journal* for March, Mr. F. Hope-Jones questions whether the trouble and expense involved are worth the results achieved, and suggests that a simple receiving apparatus should be installed at each clock with which the caretaker could note the time signals from Paris. In this case no licence for transmitting signals would be required, and the ether would not be filled with untruthful time signals.

Mathematical Notation.—In order to facilitate the compositor's task in the setting-up of articles in which vector symbols occur, especially in concrete expressions, where modulus and argument are both required, Mr. F. Jacob, M.Inst.C.E., suggests the use of the dagger "†" inverted for positive, erect for negative arguments, between modulus and argument.

Thus, $h_\theta = h\dagger\theta$ for $h\,e^{i\theta}$ or $h|\underline{\theta}$ for positive values, and $h\dagger\theta$ for negative values of θ. A numerical example, $1{\cdot}72\dagger 13° 36'$ illustrates the advantage.

The point of the dagger follows the usual convention for + and − direction.

Mr. Jacob points out that we have a very apposite precedent in $n!$, which, for the purpose above-mentioned, replaces the original factorial symbol $|n$.

Electric Vehicle Tire Guarantees.—In view of the fact that the "Ring" of solid tire manufacturers has decided in future only to guarantee such tires for a service of 10,000 miles within a period of 12 months, Messrs. Edison Accumulators, Ltd., have decided to undertake full responsibility of guarantee of all tires sold by them with their electrically-propelled vehicles, and all solid tires coming within this category will be guaranteed for a service of 12,000 miles within a period of 15 months. This decision is based on their experience of the superior qualities of the electric vehicle, both in this country and the United States, in the matter of increased mileage on tires of such vehicles.

Central Station Men and Recruiting.—In the House of Commons on Tuesday, Mr. Touche asked the Under Secretary for War whether he was aware that many men formerly employed in the electrical services in the metropolis had joined the Forces; that others were desiring to join and, owing to the technical and expert training required, their places could not readily be filled, and there was some risk of the power stations, the output of which was largely used for Government purposes, becoming insufficiently manned; that representations had been made, at the instance of the general officer commanding the London district, of the importance of preserving the efficiency of electric and power services of the metropolis, but in the absence of some public service or other badge authorised by the Government, which could not be forged, to protect the men from reproach for not enlisting, it was difficult to persuade them to remain; was he aware that proposals submitted by the Association of Municipal and Electrical Engineers of Greater London had not resulted in any satisfactory solution of the difficulty; and would he consider the question of either authorising the issue of an officially recognised public works badge, or of enlisting the men employed in approved public utility services in a special volunteer body authorised to wear uniform, as in the case of the Civil Service Corps?

Mr. Tennant: Recruiting officers have instructions not to enlist skilled employés of electrical services without the sanction of their employers. I am informed that several electrical companies, who have applied for War Office badges, have been offered such badges for issue to men of recruitable age who would be willing to enlist if called upon in the event of emergency, or of their ceasing to be urgently required in their present employment.

Mr. Touche: Are these official badges what I call War Office badges?—Mr. Tennant: Yes, they have been offered these badges.

Mr. Touche: Official badges?—Mr. Tennant: Yes.

Mr. Terrell wanted to know how these badges would differ from those given to persons engaged upon munitions of war.

Mr. Tennant pointed out that the badges for makers of munitions of war exempted the wearer from all war service, inasmuch as he was helping to produce the munitions of war. The other badges would not in all cases exempt a man from military service, and in the case of emergency arising he would be called upon to serve, unless he were urgently required in his present employment.

Mr. Terrell: Are two classes of badges issued, and to whom is application to be made for these badges?—Mr. Tennant: When the hon. gentleman says there are two classes of badges, that is not so. This has been offered and has not been accepted. We are prepared to issue it. Application should be made to the secretary to the War Office.

Mr. Touche: Is it a condition of the issue of the badge that the man who receives it shall give an undertaking to join the Colours if called upon to do so?—Mr. Tennant: That is so.

The matter then dropped.

Australian Association of British Manufacturers.—The annual general meeting of this Association was held at the Commercial Travellers' Club, Melbourne, on Friday, February 26th. The chairman, Mr. Geo. Shrimpton, submitted the annual report, which stated, amongst other matters, that the membership had now increased to 238, being 120 British manufacturers and 118 representatives of British manufacturers. During the year a Sydney branch of the Association had been formed, and a Sydney Council had recently been elected. The Executive Council were pleased to be able to report that under the new Tariff a greater measure of preference had been granted to goods of British origin. This matter had been strongly urged by the Association since its formation. A list of those items which received an increased measure of preference, numbering 352, was printed with the annual report. The following members were elected as members of the Executive Council for the ensuing year:—

President.—Mr. Geo. Shrimpton (Geo. Shrimpton & Sons).

Vice-President.—Mr. C. W. U. Adamson (Babcock & Wilcox, Ltd.).

Councillors.—Mr. F. A. Daniel (H. S. Ingamells & Co.); Mr. John D. Campbell (Alexander Fergusson Pty., Ltd.).

Hardware Councillor.—Mr. W. H. MacLennan.

Electrical Councillor.—Mr. G. L. Just (Edison & Swan United Electric Light Co., Ltd.).

Members urged that the Association should take steps to guard against the possibility of any reduction of the increased preference granted to goods of British origin, which might be suggested as a result of agitation on the part of importers of American and other foreign goods. The chairman assured members that the matter would receive the fullest attention of the Executive Council, and that any members wishing for assistance could rely on the fullest co-operation of the Association. The question of duty on catalogues was discussed, and keen disappointment was expressed that the Government had increased the rate of duty. The chairman advised members that the Association was still urging the reduction of this duty, and a letter on the subject, addressed to the Minister of Trade and Customs, was read and approved of by the meeting.

For Sale.—The whole of the electrical apparatus used in lighting the Liverpool Exhibition is to be sold by auction by Messrs. P. Huddleston & Co., on May 12th, at the Exhibition Buildings. Particulars are given in our advertisement pages to-day.

Sydney Electricians.—An Australian newspaper states that the labour market in Sydney is decidedly satisfactory, so far as electricians are concerned. Fitters and mechanics with a knowledge of local requirements are in demand, particularly at Garden Island and the Public Works Department.

More Gas.—We notice in the pages of a provincial contemporary, devoted to the gas interests, an advertisement which purports to illustrate the interior of the gas equipped kitchen of the First Eastern R.A.M.C. Hospital, at Cambridge. Everything appears to be spick and span, including the chains and cooks of the gas lamps. However, it happens that the whole of the hospital is electrically lighted by the Cambridge Electric Supply Co., whose wiring department supplied and fixed all the wiring, together with electric sterilisers in the operating theatre and a motor-generator for X-ray apparatus, and by a regrettable oversight a tumbler switch still remains on the illustration. The illustration bears the legend: So-and-So's gas-heated cooking apparatus installed at the First Eastern R.A.M.C. Hospital, Cambridge—the gas lighting, which is not there, being apparently thrown in to avoid the injury to the feelings of the reader of the paper, which an electrically illuminated kitchen would no doubt cause. By a coincidence, a letter appears on the facing page, headed "Abuse of Advertisements"!

Appointments Vacant.—Two assistant storekeepers, age 25-40 (£250) for Nigerian Government Posts and Telegraphs Department; engineers-in-charge (£120) for Newport Corporation; junior engineers, age about 21 (25s. plus war allowance), for Cleveland and Durham Electric Power, Ltd.; junior assistant electrical engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd. (15s). Particulars are given in our advertisement pages.

Inquiries.—Makers of the "Cordless system of heating, as used for irons," and of the Mitchell electric hair-drier, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Stafford T.C. has decided that MR. W. H. ROBINS shall be appointed engineer and manager of the electricity works; and MR. W. M. VALON, as secretary for the works.

The Aylesbury U.D.C. has appointed MR. H. H. SUTCLIFFE, of Hempton Bridge, as assistant electrical engineer.

MR. C. CLARE ATCHISON, Rochdale borough electrical engineer, who has been on the sick list for some considerable time, has now resumed duty.

Tramway Officials.—MR. T. C. WINFIELD has been appointed works superintendent of the West Ham Corporation Tramways. Mr. Winfield formerly held a similar position under the Metropolitan Electric Tramways Co. There were 127 applicants for the vacancy.

General.—After serving as chairman of the Croydon Lighting and Electricity Committee since 1897, when it was formed, ALD. D. B. MILLER, J.P., has resigned, under medical advice. Ald. Miller was chairman of the General Purposes Committee in 1890, when an application for a provisional order for electric lighting was decided upon. The Borough Council, on Monday, passed a resolution recording appreciation of the very valuable services of Ald. Miller, and the fact that he leaves the Council electricity undertaking in a state of high efficiency.

COUNCILLOR WHITESIDE and COUNCILLOR MARPLE have been appointed chairman and vice-chairman respectively of the Stretford Electricity and Tramways Committee.

It is announced in the Press that SIR ALEXANDER KING, late secretary to the Post Office, has been elected a director of the West India and Panama Telegraph Co., Ltd., in place of the late Sir John Lamb.

NEW COMPANIES REGISTERED.

East Lancashire Electrical Co. (Accrington), Ltd. (140,029).—This company was registered on April 21st, with a capital of £1,000 in £1 shares, to carry on the business of electric, silver or nickel platers and polishers, electric light and power engineers, makers of electric cooking and heating apparatus and machinery for electrical, mechanical and textile purposes, dealers and makers of all kinds of motors and motor-car appliances and accessories, etc. The subscribers (with one share each) are: G. W. Somerville, "Roseneath," Owen Street, Accrington, electrical engineer; F. G. Clarke, 99, Stanhill, Oswaldtwistle, electro plater and polisher. Private company. The number of directors is not to be less than two or more than five; the first are G. W. Somerville and F. G. Clarke. Qualification £25. Solicitor, F. G. Lupton, 11, Dutton Street, Accrington. Registered office: Paradise Street, Accrington.

Ardee Electric Co., Ltd (4,235).—This company was registered in Dublin on April 22nd, with a capital of £5,000 in £1 shares, to acquire and carry on the business of an electric light, heat and power producer, generator and distributor, etc., carried on by J. W. McKeever, J.P., at Ardee, Co. Louth. The subscribers (with one share each) are: J. W. McKeever, Aclare Lodge, Ardee, Co. Louth, farmer; T. W. Storey, Ardeevin, Bailey, Co. Dublin, A.I.E.E., C.E. Private company. J. W. McKeever is the first director. Qualification, 50 shares. Registered office: Ardee, Co. Louth.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Charing Cross, West End and City Electricity Supply Co., Ltd. (29,122).—Capital £2,100,000 in 130,000 pref., 130,000 ord., 80,000 City Undertaking pref., and 80,000 City Undertaking ord. shares of £5 each. Return dated March 18th, 1915. 80,000 pref., 80,000 ord., 80,000 City Undertaking pref., and 70,000 City Undertaking ord. shares taken up. £1,200,000 paid on the pref. ord. City Undertaking pref.; £350,000 considered as paid on the City Undertaking ord. Mortgages and charges, £1,087,178.

W. T. Henley's Telegraph Works Co., Ltd. (13,795).—Capital £400,000 in 40,000 pref. and 40,000 ord. shares of £5 each. Return dated April 2nd, 1915. All shares taken up. £5 per share called up on 39,880 pref. and 32,616 ord.; £362,480 paid; £37,520 considered as paid on 120 pref. and 7,384 ord. Mortgages and charges, £150,000.

Direct Spanish Telegraph Co., Ltd. (6,732).—Capital, £95,000 in 13,000 ord. and 6,000 pref. shares of £5 each. Return dated April 1st, 1915. 12,931 ord. and 6,000 pref. shares taken up; £94,655 paid. Mortgages and charges, nil.

Notting Hill Electric Lighting Co., Ltd. (25,921).—Capital £201,352 10s. in 17,002 non-cum. 6 per cent. pref. and 2,998 cum. 6 per cent. pref. shares of £10 each, and 27,050 ord. shares of 1s. each. Return dated March 9th, 1915. 11,402 non-cum. pref., 2,998 cum. pref., and 27,050 ord. shares taken up; £145,352 10s. paid. Mortgages and charges, £64,000, and jointly with the Kensington and Knightsbridge Electric Lighting Co., Ltd., a further £231,500.

Telephone Co. of Egypt, Ltd.—A memorandum of satisfaction to the extent of £1,300 on April 14th, 1915, of deb. stock, covered by deeds dated from July 27th, 1904, to October 27th, 1909, securing £200,000 has been filed.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,738).—Capital £350,000 in £1 shares. Return dated March 24th, 1915. 320,000 shares taken up; £320,000 paid. Mortgages and charges, nil.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

MR. HERBERT ALLEN presided at the London Chamber of Commerce, on Friday, over the annual meeting. He said it was unnecessary to dilate at any length on the accounts, which, as regarded the profit and loss, presented no particular feature. There was what they had come to regard as the customary growth in gross income, but the increase in net profits was not quite commensurate with the increased revenue. A large additional staff was engaged last year for the company's new exchange in the North of Lisbon, but the actual opening of the exchange did not take place until after the close of the year, so that they had the additional expense without a corresponding increase of income, and it might be said that about £20,000 of last year's capital expenditure was only just beginning to be productive. It was partly in anticipation of this that he thought he ought last year to prepare them for a possible temporary set-back in their dividend, especially in view of the recent increase in the share capital; but, happily, the board had not felt it necessary to encroach upon the usual distribution of 8 per cent. On their new exchange this year they anticipated having a considerable accretion of business with but a moderate addition to their expenses. At the same time, there was no gainsaying the tendency, not only with this company, but with most of the telephone enterprises, to have to lay out more money and do more work than formerly for a given return. Mr. Gill, the company's consulting engineer, had recently visited Lisbon and was well satisfied with the condition of their three exchanges there. With regard to the balance sheet, the only item calling for attention was the reduction of sundry creditors from £28,774 to the more normal level of £13,525. The completion of the North Exchange was the most important work of the year, and accounted for £19,542 of the total capital expenditure of £27,229. The switchboard of the new exchange was of the latest type, being known as the No. 1 relay common battery of the Western Electric Co. It was already fitted for 1,800 subscribers, and had an ultimate capacity of 6,000, so that, although the district served by the new exchange was rapidly extending, its telephone needs for many years to come were amply provided for. They had partly carried out the programme foreshadowed at the last meeting with regard to the question of depreciation. Instead of continuing to build up indefinitely what in the balance sheet was, perhaps, somewhat misleadingly, called the reserve fund—which was liable at any time to be appropriated to a reduction of capital expenditure or written off for depreciation—they were inclined in future to write off depreciation year by year. The 1913 accounts closed with a reserve of £55,000, and £30,000 of this they had since appropriated to a reduction of capital expenditure, from £290,355 to £260,355. That left them with an unappropriated reserve of £25,000, and this sum added to the renewals fund they considered ample to cover any further depreciation. Largely arising out of the political situation of Portugal, which was anything but satisfactory, there had been a further rise in the premium on gold. Fortunately, however, their remittances were protected by bills which they had bought ahead, and this was shown by the fact that although the exchange on London at the end of the year had declined to 36d., they were still remitting at 44d. per escudo. In order to protect themselves as far as possible against any further fall in exchange, they had recently bought bills enough to cover their remittances for the current year, although at a price which compared unfavourably with what they got last year. Although political and commercial condi-

tions in Portugal at the present time were so unsettled they were not reflected in the business of the company, which was continually expanding, and there was no falling off in the demand for telephone facilities. But now that the North Exchange was completed and paid for they ought to be able to meet this demand for some time to come by a very moderate expenditure of capital: That being the case, and having successfully got through what he might perhaps call their financial transition of 1914, there seemed no reason why they should not be able to look for a continuation of what had come to be regarded as their normal 8 per cent. dividend. This, however, was largely a question of the course of exchange.

Mr. F. Kerr seconded the motion and it was carried.

Willans & Robinson, Ltd.

The directors report that the accounts for 1914 show a net profit of £17,058, after payment of debenture interest, provision for depreciation of plant, machinery and stocks, and the proper upkeep of Queen's Ferry Works. These latter have been utilised by the Government in connection with war requirements since August last. Warrants will be issued covering dividends on the "A" and "B" preference stocks, and interest on outstanding funding certificates. A dividend at the rate of 10 per cent. is recommended on the ordinary shares, leaving a balance of £9,108. Of this sum it is proposed to carry £7,431 to the reserve fund, which will thus exceed the minimum provided for by the Articles, and to distribute the balance, £1,677, among the holders of "B" preference stock and ordinary shares in manner provided for in the Articles. In common with those engaged in engineering work similar to that of this company, the outbreak of war largely disturbed the company's usual business, but the directors are glad to report that they were able to be of early service to the Government, and are now largely engaged in that direction. This latter work, though partly undertaken towards the end of 1914, is not reflected in the accounts now submitted. A large number of the company's staff—both from works and offices—having joined H.M. Forces, arrangements were made for substantially assisting their dependents and for re-employment after the war. The number so far serving represents over 20 per cent. of the total male employés. During the year the directors accepted, with regret, the resignation of Mr. Leslie Robertson, and subsequently appointed Major P. M. Peters to the vacancy thus created. As the former would have been the retiring director at this period, it falls to Major Peters to retire, who, being eligible, offers himself for re-election. Mr. G. W. Anderson proposes to retire at the annual general meeting, and the shareholders will be asked to leave to the directors the question of appointment to fill the vacancy.

Annual meeting, May 6th.

Indian Electric Supply and Traction Co., Ltd.

The annual meeting was held on April 22nd at the offices, Orient House, New Broad Street, E.C. Mr. J. G. B. Stone, who presided, said that the directors were glad in these times to be able to record further expansion of the company's business. The net revenue had risen from £10,161 to £12,724, and the balance carried forward to the new year's working was £7,365, against £5,226 in 1913. Interest charges had risen from £3,600 to £3,855. The street lighting contract alluded to at the last general meeting had augmented the income this year and considerable extensions were now being put in hand. The past year had been a notable one, but as far as could be ascertained the progress of the undertaking had not been materially affected. Where there had been any set-back caused by the war, it had been offset by increased sales to customers to whom the war had brought increased business. There was no material change in the tramway position, and they could not hold out any immediate prospect of improvement; but as the supply side of the undertaking continued to grow, their interest in the tramway became of less import- and the amount received per unit was 1·86d. The higher price ance. Generating costs had fallen from 1d. to .83d. per unit, of coal had been more than offset by the increased efficiency of the plant, so that although they paid 14 per cent. more for coal there was a fall in the coal cost from .58d. to .46d. per unit. The board sincerely regretted that Mr. Cruickshank should have found it necessary through ill-health to retire. In his place they had been fortunate in securing the assistance of his partner, Sir George Sutherland, who was well acquainted with Cawnpore and the business. He (the Chairman) had particular satisfaction, in these times, in asking them to approve the increased dividend which, one felt, indicated the progressive nature of a business of this character when once it was firmly established.

Mr. K. A. Scott Moncrieff, in seconding the motion, said that at the last meeting he ventured to forecast considerable improvement in their working costs, and the figures for the year showed that he was quite justified. The growth of the business made it difficult to compare one year with another, as the output had been so largely increased. The actual result, however, might be explained in this way—they had sold 33 per cent. more units last year, and to do that they spent only 6 per cent. more on coal, in spite of a rise of 14 per cent. in coal prices. The extra units sold had resulted in an increase in the revenue of £3,679—a 22 per cent. increase, while the increase in the total costs at Cawnpore was only 8 per cent. The results of their increased operations in the field of power supply was that the average receipt per unit had fallen, but the average profit per unit was practically stationary—1.03d. as against 1.05d. in the previous year. The one feature in considering those results was that of the demand upon their plant. Last year they had used 12 per cent. more of the plant in order to sell 33 per cent. more current. There had been an increase of 14 per cent. in the connections during the year, very largely in the way of motors for power purposes; 13 motors, having an aggregate of 220 H.P., had been added to the mains during the year. Another feature of the year was that the street lighting which they did under contract had been extended, and within the last few months further extensions had been arranged for. The additional lamps last year were 600, and they had in view some 1,300 or 1,400 more. He believed that they had a large field before them for the development of the industrial power supply of Cawnpore, and it was quite possible that the extension of the boundaries of the city might later on lead to a paying proposition for the extension of the tramways. They had no technical difficulties whatever; all they had to do was to keep their plant in order and extend the mains. They could see room for a reduction in working costs and a saving of losses in the mains which, without any increase of business, would give them some increase of profit in the current year.

The report was adopted.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—A dividend for the quarter ended December 31st last of 2s. 6d. per share is recommended, together with a bonus of 4s. per share, payable, free of income-tax, on the 12th prox., making 7 per cent. for the year.

Brisbane City Electric Light Co., Ltd.—The directors' report for the year ended January 31st, 1915, states that, after making additions to the franchise and purchase sinking fund, and renewals, replacements and contingencies account, and reserve fund, there remains a credit balance of £20,637. An interim dividend, with dividend duty in September last, amounted to £8,205, and a further dividend of 3 per cent. on the preference shares and 7½ per cent. on the fully-paid ordinary shares, and 7½ per cent. on the contributing shares, together with the dividend duty, will absorb £12,383, leaving £1,316 to be carried forward.

Dudley and Stourbridge and District Electric Traction Co., Ltd.—The total revenue for 1914 was £50,780, compared with £52,843. It is proposed to pay 1 per cent. for the year on the ordinary shares, carrying forward £851.

Wolverhampton District Electric Tramways Co., Ltd.—Tne revenue for 1914 was £28,359. The directors propose to pay a dividend of 1 per cent. per annum on ordinary shares, leaving to be carried forward £386.

Southport Tramways Co., Ltd.—The report states that the total revenue, including £106 brought forward, amounted to £17,142. After deducting all expenses, including £5,573 payable to the Corporation under agreements, in addition to £1,053 for maintenance and a provision of £500 for renewals, there is a balance of £650. The directors recommend (says the *Financier*) that £500 be placed to reserve, leaving £150 to be carried forward.

Nairobi Electric Power and Lighting Co., Ltd.—Extraordinary meetings are to be held on May 5th and June 2nd, says a financial daily, to consider a resolution converting the preference shares into ordinary shares as from June 30th, 1915, in consideration of a bonus of 12½ per cent. being paid in fully-paid ordinary shares or cash at the option of the company.

O. C. Hawkes, Ltd.—The net profits for 1914 amount to £7,714. The directors have paid 5 per cent. on preference shares, carrying forward £1,702.

Mexborough and Rawmarsh Construction Syndicate, Ltd.—The report states that the balance to credit of profit and loss account, including £119 brought forward, is £4,826. The directors recommend a dividend of 2½ per cent. (free of income-tax), carrying forward £14.—*Financial Times.*

West India and Panama Telegraph Co., Ltd.—The directors recommend the following dividends:—6s. per share on the first preference and 6s. per share on the second preference for the last six months of 1914, and 9d. per share on the ordinary shares (free of income-tax).

City of Buenos Ayres Tramways (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less income-tax, for the three months ended March 31st.

Colombo Electric Trams and Lighting Co., Ltd.—The directors have declared a dividend of 10 per cent, free of tax, for the year 1914, carrying forward £8,010. £20,000 has been transferred to general reserve and renewals fund.

Eastern Telegraph Co., Ltd.—The directors recommend a final dividend of £1 5s. per cent., and a bonus of £2 per cent., both free of income-tax, making a total of 7 per cent. on the ordinary stock for the year 1914.

La Plata Electric Tramways Co., Ltd.

The directors' report for 1914 states that the total length of single track constructed and in operation during the year was 28.67 miles. The total receipts on revenue account amounted to £56,186, and the expenditure to £44,273, leaving a balance of £11,913. After providing for debenture stock and other interest (£5,629) there remains £6,284, plus £330 brought forward, leaving £6,614. The directors regret the falling off in receipts, which is entirely due to the unprecedented depression in Argentina. In view of the necessity of husbanding the company's cash resources owing to the financial conditions caused by the European war, they recommend that the balance of £6,614 be carried forward.

Mr. W. F. Hamilton, K.C., presided, on Tuesday, at Winchester House, E.C., over the annual meeting. He said that the total receipts for the year amounted to £56,186, a decrease of £6,138. The total expenditure was £44,273, a decrease of £2,119. The net result was that, including the amount brought forward, there was a balance of £6,614, which the board recommended should be carried forward. The falling off in the receipts during the past year, and, he was also sorry to say, during the current year, so far as at present known, was very disappointing, and was a matter of grave concern to the board. Their company, however, was not the only sufferer, as nearly all other companies in Argentina, especially tramway and railway companies, have shown great decreases. This was due to the severe financial crisis the country had been going through, which began in 1913, continued through 1914, and had been accentuated since the war broke out. For the first seven months of the year, the decrease in traffics was 7.5 per cent., and for the last five months 12.9 per cent., the percentage for the whole year being 9.7. La Plata had additionally suffered through the financial difficulties of the Province of Buenos Aires, of which it was the capital. Arrangements had had to be made for funding for two years the interest and sinking funds of certain of the external loans of the Province, and to reduce expenditure the salaries of State officials had been reduced by 10 per cent. For years foreign capital had poured into the Argentine, and immigration had largely exceeded emigration. During the past year the influx of capital ceased, emigration exceeded immigration by more than 60,000, and there was considerable unemployment. These drawbacks were increased by deficient harvests and persistent bad weather. On the other hand, it was satisfactory to know that their manager had been successful in his untiring efforts to reduce expenditure. The working expenses for the year averaged only 6.37d. per car mile run, as compared with 6.66d. in 1913. He also deserved great credit for reducing the cost of motive power during the year by no less than £1,012, as compared with 1913, although 12,888 more car miles were run, and the contract price per unit was higher. Traffic charges were less by £925, notwithstanding the increased car mileage. The consumption of electric energy in watt-hours per car kilometre, which was reduced from 777 to 671 in 1914, had been still further reduced this year to 547 for January and 556 for February. While their manager was in this country for a short holiday he devoted most of his time to the problem of reducing the cost of motive power, which now compared very favourably with other systems. In the revenue account there was an item of £606 for the expenses of the action against the late local auditors. Having regard to the costs which had been incurred and would be incurred, which were much heavier than was anticipated, and to threatened litigation in the Argentine, and to the state of circumstances brought about by the war, they thought it prudent, after giving the matter their most anxious and careful consideration, to settle the action upon the terms that the parties should pay their own costs and that an end should be put to all litigation between the parties. Referring to the balance sheet, the item of sundry creditors was composed principally of the amount due under contract for motive power for December, the men's wages for the last fortnight of December, the directors' fees for the last half-year, which had not yet been paid, and an advance by Mr. Western of £500 to help the company's finances. On the other side of the balance sheet, the item "payments under protest for paving including amounts embargoed" were payments made in respect of accounts rendered by the Municipality for paving on a basis which the company did not admit. The payments had been made under protest, in order to avoid law costs. But they were assured that the overcharges by the Municipality would be refunded by the Government, or credited to the company in respect of amount properly chargeable to them for paving in accordance with their concession contract, and he wished to acknowledge the friendly attitude of the Government in dealing with this question. During the year the extension of their line along Calle 17 to the Meridiano Quinto Station, representing nearly 1,800 metres of single track, was completed and was to be opened soon after the new year. They also had in hand the construction of a short piece of line some 1,300 metres long on the embankment along the canal at Ensenada, the cost of which would be small. This work was to be completed last month. They hoped that both these extensions would be profitable. Out of the balance available they would have liked to pay a small dividend on the preference shares, but as their capital account was indebted to revenue, they would require to borrow money to do so, and this would be a matter of extreme difficulty, if at all possible, just now. When he last addressed them he told them that they had under consideration the issue of some of their available debenture stock to recoup revenue and pay off their existing loan. In normal times they could have done so, but at present it was out of the question, so that they saw no alternative but to carry forward the balance of revenue account to next account. There were indications of an improvement in the state of affairs in Argentina, but he was afraid they could not look forward to much improvement that year. If the business of the company improved and their cash position justified it, the board would be pleased to declare and pay an interim dividend out of the carry-over.

Mr. W. T. Western seconded the motion, and the report was adopted.

In moving a vote of thanks to Mr. Brown, the manager, and the staff, the Chairman spoke in high terms of the work done by the manager, who, he said, had secured several concessions for the company at no cost to them, which might be of value later on.

Mr. Boutell, the local director of the company, remarked that he had never known such times before in the River Plate during the 42 years he had been there, but he was certain things would gradually improve and that the company would benefit.

Direct United States Cable Co., Ltd.

Sir James Pender, Bt., presided over the annual meeting, held on Tuesday, at Winchester House, E.C. He said that they had received the rent stipulated in the lease from the Western Union Co., and they had been exceptionally fortunate during the year in regard to the cost of maintaining cables. In the year ending March 31st, 1913, they had an expenditure in this connection of over £42,000, and in the following year of over £58,000, or a total for the two years of over £100,000. The effect of this heavy charge was a material increase of the capacity of the cable by the insertion of two long lengths of cable of the latest type, and possibly this accounted for the freedom from interruption the cable enjoyed in the past year, when the cost of maintenance was less than £2,000, which he believed was less than they had expended on cable repairs in any year since the inception of the company. The result had been to increase the reserve fund from £451,490 to £476,986, or an addition of £25,495. There might be a feeling in the minds of some of the shareholders that out of such a large surplus on the year's receipts the directors might have paid a bonus. He felt, however, that they were best serving the interests of the shareholders by continuing the policy that had always been followed of building up reserves to such a figure that they provided for any contingencies which human foresight could foresee, and as the fund had been so largely depleted in the two previous years by the heavy charges to which he had referred, he was sure the shareholders would agree that they had acted wisely in deferring the payment of a bonus. They had had evidence on many occasions of the keen interest the shareholders took in the old staff of the company, who were now, of course, in the service of the Western Union Co., and it might be noticed that the contribution to the pension fund was slightly increased. That fund existed for the benefit of the late employés of the company, and under the conditions of the lease the position of the fund required to be periodically reviewed, and the annual contribution by the Western Union Co. would thus from time to time be varied. The figure which appeared in the present accounts would remain in force for the next five years. The only other item on which he need remark was the cable on hand, which appeared in the balance sheet at £77,661. In view of the two deep sea interruptions which occurred in 1913 and 1914, the board came to the conclusion that it was necessary that they should keep a sufficient length of cable in hand to ensure the successful carrying through of any similar repair. The contract for its manufacture was very favourable from the company's point of view, and the present value of the cable was largely in excess of the figure at which it appeared in the accounts. In addition to that, they might congratulate themselves upon having laid in this necessary stock of cable at a time when they were able to realise investments to pay for it without incurring the great loss which would result from the sale of securities at the present time. Heavy depreciation in all classes of securities since the war had had the effect of reducing the present value of the company's investments to such a figure that the provision of £50,000 on account of market depreciation was insufficient. In the present unsettled condition of affairs the directors thought it unnecessary to increase that sum, and they were hopeful that when the war was concluded, and business conditions resumed the normal, investments would recover their original value, and until that time they hoped it would not be necessary to realise any of them. Their relations with the Western Union continued to be of the most friendly nature, and, notwithstanding the war, he believed that the cable traffic had been more than maintained.

Mr. John-Varney seconded the motion, and the report, which recommended a final dividend making 4 per cent. for the year, was adopted.

Potteries Electric Traction Co., Ltd.

Mr. R. J. Howley (Chairman) presided on Monday at the annual meeting at the Electrical Federation Offices, Kingsway. He said that at the outbreak of war Mr. G. F. M. Cornwallis West was recalled to the Colours, and later, for private reasons, intimated that he had decided to resign the chairmanship of the company. Mr. West had for many years ably directed the fortunes of the company as chairman, and they all regretted his resignation and wished him a safe return. At the time Mr. West had to leave, the company was actively negotiating with the Stoke Corporation for an extension of the dates at which the tramways within the borough could be purchased, and as he had been associated with Mr. West in the negotiations he was asked to join the board. With regard to the accounts, a little explanation was necessary owing to the inclusion in the receipts and expenses of the omnibus services, which made a comparison with last year's accounts of little value. In the revenue account the traffic receipts had risen from £109,924 to £115,082, an increase of £5,158. The increased revenue brought in by the omnibus services amounted to £9,947, so that the tramway section showed a decrease compared with last year of £4,789. This was most disappointing, and was wholly attributable to the war, as at the beginning of August the tramways were doing better than ever before, and showed an increase of some £2,000. Parcel receipts, which were this year shown in a different form, amounted to £1,325, and represented net receipts, which, as compared with last year, was an increase of £131. Advertising receipts showed a slight decrease, due to a rearrangement of the business with their contractors. On the other side of the accounts, power and running expenses showed an increase from £33,828 last year to £41,973 this year, and this was due to the inclusion of the cost of working the motor omnibuses. When the war broke out the directors took immediate steps to reduce the tramway expenditure, and to a large extent had been successful. He did not propose to split up the various figures between the tramways and the omnibuses, as it was not, he thought, in the interests of the shareholders, but they might take it that between August and the end of the year the saving on the tramway side of the business was nearly £2,000. The saving was really greater than it appeared, because earlier in the year an increase had been granted in wages to the employés, and this increase affected to some extent the saving made in the second half of the year. Administration and general expenses showed an increase from £10,232 to £11,009, to some extent accountable by the omnibus business, whilst the negotiations with the Stoke Corporation had necessarily increased the legal expenses. At the outbreak of the war the British Electrical Federation, of which they were members, took steps to care for the wives and dependents of the employés of the federated companies called up for service. A fund was established, called the British Electrical Mutual Aid Fund, to which the employés contributed weekly, and the amount so subscribed was doubled by the subscription of the company. The fund was distributed by a local committee of the men themselves working under a general committee in London, and it had been a complete success. The company also associated itself with the other companies in a joint contribution of £1,500 to the Prince of Wales' National Fund, £250 to the Belgian Relief Fund, and £100 to the British Red Cross Fund. With regard to the capital account, the only point was the new expenditure during the year amounting to £12,072. Of this £8,608 was incurred in connection with the establishment of the motor omnibus branch of the business, and the remainder on small works of improvement incidental to every undertaking. For the time being this expenditure had been financed from the fund set aside for renewals and general reserve, but this arrangement was only temporary, and before long further capital must be raised, both for releasing the renewals fund and to provide for the doubling of portions of the line and the provision of new rolling stock which would be necessary if the negotiations with the Stoke Corporation proved successful. Including £10,000 set aside for renewals, the fund available for distribution amounted to £36,571, as against £39,074 last year, a decrease of £2,501. In view of the prolongation of the war through the current year, and the necessity for the company to husband its resources, the directors thought it wise to reduce the dividend on the ordinary shares from 3½ per cent. to 2½ per cent., and to carry forward an increased amount. £10,000 was set aside for renewals, which amount set aside each year over a term of years should be sufficient to keep the tramways going in an efficient condition. The amount allocated to general reserve had been increased, which was a prudent course in the present circumstances of the company. With regard to the negotiations with the Stoke Corporation, their undertaking was subject to the usual tramway terms, and became purchaseable in 1917-18. Naturally, towards the end of a term the undertakers were unwilling to incur fresh obligations and carry out improvements, and he was glad to say the Corporation had recognised the difficulty. The points under discussion were the postponement of the date of purchase to 1940, the expenditure of a maximum sum of £35,000 on improvement, and the payment of £2,000 on wayleaves, and he hoped a satisfactory solution would be arrived at. The company had expended between £700,000 and £800,000 on the undertaking for the public service with little profit to itself, and they were entitled to some consideration from the public authorities and the protection of their property from direct competition. During the year the motor 'bus services had been worked under great disadvantages. Owing to the difficulty of obtaining delivery the full fleet of 14 'buses was only completed in August, just as the war broke out, and new routes had to be surveyed and services arranged. All this preliminary work took time, and it was not until the autumn that the service was established. The result of the working till the end of the year was little or no profit, but a considerable amount of experience had been gained, and the board were satisfied that it would in future prove a valuable adjunct of the business.

Mr. S. Mear seconded the motion, which was carried without discussion.

Indo-European Telegraph Co., Ltd.

The directors report that in consequence of the state of war between Great Britain and Germany, the German section of the company's lines has been interrupted since July 31st, 1914. The question of re-establishment of the company's through route at the earliest possible moment is engaging the board's earnest attention. Owing to existing arrangements with other companies, the receipts derived from telegraphic traffic for the year have been maintained. The state of war has also put an end, for the time being, to practically all experimental work on wireless telegraphy, and the development of the Galletti system previously referred to has been accordingly suspended. The company's revenue from message account and other sources amounts to £189,384, an increase of £16,852. The expenses are, on commercial and general account, £59,856, and on maintenance account £28,540, making a total of £88,395, as against £91,441 for 1913, a decrease of £3,046. The revenue account, therefore, shows a balance of £100,988, which is carried to profit and loss account, 1914, and after deduction of income tax paid is reduced to £91,631. Adding the balance brought forward of £6,461, there is a total of £98,092. Deducting £25,000 provided for investment fluctuations, and the interim dividend of £10,625 already paid, there is available for distribution £62,467. The directors now recommend a dividend for the six months ending December 31st, 1914, of 17s. 6d. per share (making with the interim dividend already paid 6 per cent. for the year) and a bonus of 20s. per share, both free of income tax. They also propose to provide £10,000 for wireless and other technical development work, carrying forward £20,592. They propose further to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of income tax. The names of Herr Koehler as German official director, and of Herr Carl Joerger, Berlin, have been removed from the directorate. The directors propose to alter the minimum and maximum numbers of directors, now fixed by the Articles at 8 and 18 respectively, to the more convenient numbers of 5 and 10.

The annual meeting was held yesterday.

Calcutta Tramways Co., Ltd.

The annual meeting was held on Tuesday at the offices, 1, Queen Victoria Street, E.C., Sir Henry Kimber presiding. The Chairman said that the additions to the capital expenditure during the year had been £18,900 for additional rolling stock. On the other hand, capital had been credited with £8,100, the cost of some Lancashire boilers which were purchased in 1910 and 1911, and which had now been superseded by far superior equipment. The loss of £8,100 on the transaction had been taken from depreciation account, which account, however, had been increased by their having taken £15,000 out of the past year's profits, which brought the fund up to £80,000 as against £65,000 at which it stood a year ago. They had expended about £44,000 more on capital account than they had received, but having their depreciation fund and sufficient cash resources, they felt that that was a very small sum to have overspent themselves by. With regard to the earnings, last year the Chairman told them that they had then earned £10,000 more than in the previous year, which was a record. For several years past their earnings had been on the up grade, but last year, owing to the war, the increase was only £1,032. Up to the time of the war they were still on the up grade, as they had made £9,000 more gross profit than at the corresponding period of 1913, but the war turned the tide, with the result he had indicated. It was remarkable that the war should have had such a transcendent effect upon India, but there it was, and he thought they had great reason to be thankful that in the end they had been able to beat the best previous year's earnings by £1,000. They were paying the same dividend as last year—9½ per cent., free of income tax. The down-grade, he was sorry to say, still continued, although not to such an extent as gave rise to any fear as to the result of the year. Up to the present their receipts were really magnificent—1,151,756 rupees, which was only 71,000 rupees less than at the corresponding period last year.

Mr. J. G. B. Stone seconded the motion, and the report was adopted.

Cuba Submarine Telegraph Co., Ltd.

The total receipts for the year ended December 31st last were £38,245, and the expenses were £16,702, leaving £21,542, plus £7,849 brought forward. £3,000 has been placed to the reserve against loss on investments, £2,500 to the pension fund, and £2,000 added to the general reserve fund, which now stands at £100,000. Interim dividends were paid on October 22nd, viz., at the rate of 10 per cent. per annum, less income tax, on the preference shares, and at the rate of 5 per cent. per annum, free of income tax, on the ordinary shares. These interim dividends absorbed £7,000, and leave £14,891, out of which final dividends at the same rates, making total dividends for the year of 10 per cent. on the preference shares, less income tax, and 5 per cent. on the ordinary shares, free of income tax, are to be paid, the balance, £7,891, being carried forward. Mr. J. P. Hooper has been appointed a director in the place of the late Mr. Robert Kaye Gray, whose death occurred on April 28th last year.

Annual meeting: May 5th.

Berlin Elevated and Underground Railway Co.

The report of the Gesellschaft für Elektrische Hoch und Untergrundbahnen, of Berlin, states that an increase in the receipts took place in 1914, in consequence of the inclusion for the whole of the year of the contributions made towards the working expenses of the new connecting lines operated by the company, as compared with a similar period of only three months in the previous year. Down to the occurrence of the war the traffic, especially on the new lines opened in 1913, developed in a satisfactory manner, but after the mobilisation changes in the traffic and working conditions were manifested. It was possible in general to maintain the services by securing substitutes for the men who were called to the Colours. The sum of £15,000 was appropriated from the fund for extraordinary expenditure for the purpose of granting war relief. The route length of railway in operation was 17 miles, being the same as in the previous year. The accounts show the following figures for the past two years:—

	1914.	1913.
Ordinary shares (paid up) ...	£2,625,000	£2,625,000
Preference shares (5 per cent.) ...	1,000,000	—
Loan capital	3,991,000	3,992,000
Gross profits	418,000	355,000
Interest on loans	149,000	97,000
Redemption and renewal funds ...	57,000	49,000
Net profits and balance forward ...	190,000	184,000
Reserve fund	7,200	7,300
Dividend on ordinary capital ...	118,000	127,000
Dividend on ordinary capital, p.c.	4½	6
Carried forward	31,000	31,000

The number of train miles run amounted to 3,937,000 in 1914, as compared with 3,666,000 miles in 1913; the passengers carried increased from 71,525,370 in 1913 to 77,027,513 last year; and the average receipt per passenger was 1.54d., being the same as in the preceding year. It is added that the preparatory works in connection with the connecting line between the "triangle" and the Nollendorf Platz have been begun, and arrangements been concluded with the town of Schonberg in regard to the construction and operation on joint account of a two-storey underground section at the Nollendorf Platz.

STOCKS AND SHARES.

Tuesday Evening.

Something like a halt has been called to the steady upward progress of prices in the Stock Exchange markets, though it cannot be said that there has been a decided tendency one way or the other. The news of the week-end was construed by some as disappointing, although many took an optimistic view, arguing that such incidents as a German advance towards Ypres are amongst the natural events of such a campaign. But the buying movement received a check, and in some of the markets prices showed a disposition to go back a little—which, after all, is by no means surprising, having regard to the rises of this month. The more reassuring communiqué of Tuesday did much to revive confidence.

Continued strength characterises the market for Home Railway stocks, more attention being paid to them than has been the case for the past four months. In view of the good yields still obtainable on the leading stocks, and still more by reason of the Government's slight concession in favour of the companies, the notice of investors has been drawn to this section. The Undergrounds have been little more than steady, this being due to the request for advanced wages on the part of Underground Electric Railways employés, which has been met by substantial concessions from the company. How far this is likely to be made up from one direction or another it is impossible to guess, so the stocks are hanging back in the general advance established by those of the steam lines.

London Electric Railway ordinary shares are firm at 28s. 3d., this price comparing with the end-July level of 30s. Districts, it may be noted, are 4 points below their quotation at the time when war broke out; and Metropolitans are 7 points lower. The latter company's 3½ per cent. debenture stocks have been changing hands at about 83. District and London Electric Railways 4 per cent. rent charge was dealt in the other day at 89. District 6 per cent. debenture, by the way, now stands at 130, with dividends due in January and July, so that the return on the money at the present time is nearly 4⅝ per cent., and the security looks ample. Metropolitan Surplus Lands has been negotiated this week at 54½.

It is satisfactory to notice that the London and North-Western Railway Co. are still making steady progress with the electrification of the local line (high level) between Willesden and Broad Street, in spite of the double handicap of reduced staff through enlistment, and the extra demands made upon the system by the military authorities. Work on the last section, that between Dalston Junction and Broad Street, is now well in hand, although several isolated portions farther down the line have yet to be linked up. Beyond Hampstead, however, the work is so far advanced that the wooden guard to the outside rail is now in position. The scheme is, apparently, some way from completion as yet, but there is no doubt that it will prove a serious competitor with the tubes and trams linking up North-West London with the City.

Most of the Colonial and foreign electrical issues remain in public favour. Mexico Trams 5 per cent. bonds have gained 3 points at 58. There has been some nibbling at Mexican Light and Power 1st and 2nd bonds, at 50 and 30 respectively. With the re-entry of these issues to public notice, we have included some of them in our lists of prices. Two or three stocks of the British Columbia Electric Railway Co. are regaining a little popular attention. With regard to the deferred stock, it is known that the 8 per cent. dividend will not be continued; there is, in fact, some doubt as to whether the preferred ordinary will get the full 5 per cent. to which it is entitled. The price of the 5 per cent. cumulative preference stock has risen within the past few days from 75 to 80, and even now returns 6¼ per cent. on the money. The preferred, which stood at 50 about ten days ago, has gained 10 points since then.

Brazilian Tractions have receded to 58. There seem to be many sellers about at anything like 60, because the price has great difficulty in getting up to it. The 6 per cent. cumulative preference hardened to 95, and this is another security which gives 6⅓ per cent. on an investment at the current price. Canadian Generals are firm at 90 and 107 for the common and preference stock respectively, with little business doing in either. Montreal Light and Power Capital stock at 237 is actually higher than it stood at the outbreak of war. Mississippi Power preferred have firmed up to 45, and Vancouver power debenture to 79½. Pachuca bonds changed hands recently at 35, and Shawinigan Water Capital stock at 127½. Victoria Falls preference are also amongst those which command a better price now than they did last July, the current quotation being 15s.; while the 5½ per cent. second debentures at 88½ compare with 83, which was the price when hostilities started.

The Electrical Supply market is generally firm, with another rise of ¼ in County of London preference. Metropolitans hardened to 3½, but City Lights at 14⅜ are ¼ lower.

Nearly all the movements in the Telegraph market are in the upward direction, and the substantial rises recorded last week have been maintained in addition. Globe ordinary went back ¼, but otherwise the changes have all been to the good of holders. The trouble still is to obtain stock. New York Telephone 4½ per cents. have now reached par. Business in the United States is reported as booming, more especially in such branches as those engaged, directly or indirectly, in the manufacture of munitions and war stores. Within the last day or two, however, some reaction has overtaken the bounding buoyancy of the share market; and the check administered to such bullishness has been slightly reflected in a few of the markets dealing with Home investments. Marconis went back to 1¾, a fall of ¼, apparently on sales by holders a little disappointed at the failure of the market to get about 1⅞, which seems to be the sticking point. Indo-Europeans have held the recovery of £4 which they enjoyed ten days ago.

Amongst Manufacturing companies, General Electric preference at 10⅛ are the fraction harder, but Edison & Swan shares of both classes remain dull, although the partly-paid at 30s. are a few pence better on the week. British Insulated preference have risen to 6⅛, and the ordinary to 11½. The rest of the list shows steadiness. The rubber market keeps good on the whole, in consequence of the output of company reports showing costs to have been reduced below 1s. per lb. Most of the producing concerns have got their expenditure down to the neighbourhood of 11d., and some as low as 9d., per lb.; while hopes are entertained that even the last-named figure will be reduced in respect of the current year. People are buying the lesser-known shares which pay at least 10 per cent. on the money, and with a fair prospect of higher rates to come. In the Armament group, the Armstrong Co. has declared a dividend making 12½ per cent. for the year, the same rate as that paid by Vickers, but the shares of both undertakings are a little easier at 40s. and 36s. 6d. respectively, both prices including dividends of 1s. 6d. per share. The Projectile Co. is said to be contemplating repayment of all its debentures by June 1st next, and the 1s. shares, after going as high as 16s., retain a rise on the week at 15s. National Explosives are also better.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	April 27, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7⅞	—	4 10 4
Charing Cross Ordinary	5	4⅝	—	5 11 1
do. do. do. 4½ Pref.	4½	4⅝	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14⅜	— ¼	6 5 2
do. do. 6 per cent. Pref.	6	12½	—	4 18 0
do. do. 5 Deb.	5	113	—	4 9 8
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11⅜ xd	—	6 3 1
do. do. 6 per cent. Pref.	6	11⅜	+ ⅛	5 3 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	97	—	4 12 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	3½	3¼	+ ⅛	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅜	—	5 9 10
do. do. do. 3½ Deb.	3½	80	—	4 7 6
South London	5	3	—	6 18 4
South Metropolitan Pref.	7	1⅜	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅛	—	4 12 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	106½	+ ½	5 12 8
do. Def.	1½	23	—	6 10 4
Chile Telephone	8	6⅜	—	6 0 9
Cuba Sub. Ord.	5½	8⅝	—	6 5 9
do. Pref.	10	15½	+ ½	6 9 0
Eastern Extension	7	13¼	+ ¼	5 5 8
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	136	+1	5 3 0
do. 3½ Pref.	3½	74	+ ½	4 14 7
do. 4 Deb.	4	98	—	4 7 0
Globe Tel. and T. Ord.	6	11¼	— ¼	5 6 8
do. Pref.	6	12¼	—	4 17 2
Gt. Northern Tel.	22	30	—	7 6 8
Indo-European	65/-	55	—	6 0 0
Marconi	20	1⅜	— ⅛	11 8 6
New York Tel. 4½	4½	103	+ ½	4 10 0
Oriental Telephone Ord.	10	2	—	6 0 0
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88½	—	5 1 8
United R. Plate Tel.	8	6¼	—	6 8 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1¼	1 1/16	—	5 0 0
Western Telegraph	7	12⅝	—	5 2 8
do. 4 Deb.	4	93	—	4 6 0
Home Rails.				
Central London, Ord. Assented	4	77½	+ ½	5 3 3
Metropolitan	1¼	30½	—	4 2 0
do. District	Nil	17¼	— ¼	Nil
Underground Electric Ordinary	Nil	1 3/16	—	Nil
do. do. "A"	Nil	5/9	+3d.	Nil
do. do. Income	6	81	—	7 8 3
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4 5/16	+ 1/16	6 7 6
do. 2nd Pref.	5½	3¼	—	7 2 0
do. 4 Deb.	4	88	— ½	4 16 5
do. 4½ Deb.	4½	90	—	5 0 0
do. 5 Deb.	5	89½	+ ½	5 11 9
Brazil Tractions	6	58	—1	10 6 10
Bombay Electric Pref.	6	10⅜	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	80	—	Nil
do. 5 per cent. Bonds	—	58	+3	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	50	+3	—
Adelaide Sup. 6 per cent. Pref.	6	5½	—	5 14 3
do. 5 Deb.	5	103	—	4 17 1
Manufacturing Companies.				
Babcock & Wilcox	14	52/-	—	5 7 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	+ ½	6 10 5
do. Pref.	6	6⅛	+ ⅛	5 0 0
British Westinghouse Pref.	7½	1 1/16	—	7 15 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	99	—	6 1 8
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	4¼	—	5 2 7
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8⅜	—	4 14 1
Edison & Swan, £8 pd.	Nil	13/-	+6d.	Nil
do. do. fully paid	Nil	1½	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10½	+ ⅛	5 18 5
Henleys	20	11½	—	6 18 0
do. 4½ Pref.	4½	4¼	—	4 12 4
do. 4½ Deb.	4½	97	—	4 14 9
India-Rubber	5	9½	—	5 9 7
Telegraph Con.	20	87	—	5 8 6

Alderley and Wilmslow Electric Supply Co., Ltd.—The profit on the year's working, according to the *Financier*, was £3,122, plus £631 brought forward. Debenture interest takes £1,711. The directors recommend that £1,000 be placed to the reserve fund and that £1,042 be carried forward.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a " Nitric	"	19/-	..
a " Oxalic	per lb.	..	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	"	£9	..
a Bisulphide of Carbon	"	£21	..
a Borax	"	£22	..
a Copper Sulphate	"	£29	..
Lead, Nitrate	"	£35	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/6	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	£8	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	£10 2 6	..
a " Chlorate	per lb.	10½d.	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8¼d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£90	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£120	..
b " Sheet, in ton lots	"	£150	..
g Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	11¼d.	1¼d. inc.
c " Tube (brazed)	"	1/-	..
c " " (solid drawn)	"	1/0½	1½d. inc.
c " Wire, basis	"	1/-	1½d. inc.
c Copper Tubes (solid drawn)	"	1/1½	1½d. inc.
g " Bars (best selected)	per ton	£100	£6 inc.
g " Sheet	"	£100	£6 inc.
g " Rod	"	£100	£6 inc.
d " (Electrolytic) Bars	"	£86	£6 inc.
d " " Sheets	"	£104	£6 inc.
d " " Rods	"	£92	£6 inc.
d " " H.C. Wire	per lb.	11¼d.	¼d. inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	1/9	1d. inc.
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/6	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	66/6	1/6 dec.
l " Wire, galv. No. 8, P.O. qual.	"	£20	£1 inc.
g Lead, English Pig	"	£21 to £22	..
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12	..
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e " " " medium	"	3/- to 5/-	..
e " " " large	"	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/2 to 1/3½	..
p " " rolled strip & sheet	"	1/3½ to 1/6½	..
o Platinum	per oz.	165/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	"	£165 to £163	..
n " Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

North of Scotland Electric Light and Power Co., Ltd.—The company made good progress during the first half of 1914, but the war has occasioned a serious falling off during the latter half. The lamp connections in Montrose have increased from 30,192 to 33,750, equivalent 8-c.p. lamps; in Brechin from 21,506 to 22,360, and in Inverness from 35,872 to 38,969, making a total of 95,079 connected in the three towns. The gross profit, including £1,859 brought forward, is £8,795, and after meeting interest on debentures and loans, amounting to £2,819, and writing off £57 from suspense account, there remains a net profit of £5,920. The directors recommend a dividend at the rate of 3 per cent. for the year, absorbing £1,500, that £2,000 be placed to renewal reserve account, and that £2 420 be carried forward. The annual meeting was held on April 21st.

Kidderminster and District Electric Lighting and Traction Co., Ltd.—The report for 1914 recommends a dividend of 2½ per cent., carrying forward £163.

RATIONAL RATING FOR FILAMENT LAMPS.

By S. M. POWELL.

It is now some five years since the writer had the privilege of writing in these columns in favour of candle-power rather than wattage rating for filament lamps, and as this problem is still not definitely settled but rather, for reasons given below, seems likely to become a more contentious matter than ever in the near future, the following remarks may be of interest as giving a brief review of both sides of the question and, in particular, as dealing with arguments which have been advanced in favour of watt-rating.

It may be, in fact it has been, contended that since watt-rating is used by 80 per cent. of metal lamp manufacturers it must be right, or it would never have been adopted so extensively. The writer does not support this view. Owing to patent complications and the economic necessity for manufacturing on a large scale, the number of metal lamp manufacturers is relatively very small, and manufacturers have been in a position to do practically what they liked in the rating matter. It is convenient from the manufacturing standpoint to adhere to a fixed watt-rating, and hence that rating has been adopted, but it is neither desirable nor convenient from the user's standpoint. How is it, then, that the public has not complained and compelled the adoption of candle-power rating? Simply, in the writer's opinion, because of the fact that watts and candle-power have been numerically equal during recent years (at first in claim, based on the Hefner candle-power, and more recently in fact, based on the British candle-power). This coincidence is, however, purely accidental and temporary. As lamp efficiencies improve further, the numerical value of candle-power will exceed that of watts, and the desirability of candle-power rating will be much increased. It is more than probable that consumers will demand a candle-power rating, and though the position of lamp manufacturers is such that they need not accede to that demand, it would be against the best interests of the electrical industry as a whole not to fall in with consumers' wishes.

The ordinary householder is notoriously ignorant on all electrical matters, so that it is quite possible he will not be able to locate and express the cause of the confusion and dissatisfaction which he must feel if we persist in selling him lamps which are of constant wattage but steadily increasing candle-power. If we put ourselves in his place, we can only arrive at the conclusion that what he wants is a standard series of candle-powers, whether or not he has the perception to realize, and the ability to express, the fact.

The user of any lamp sets out to buy light. He is interested in what fuel or power expenditure is involved, because that determines what he has to pay for his light. The fact that so many lamps of such and such candle-power are charged for power on a wattage basis has nothing to do with the rating of the lamps, any more than a gas engine of so many horse-power is rated in cubic feet per hour, because the quarter's gas bill is based on cubic feet consumed.

Admittedly, the candle-power rating of lamps has been abused, special filament shapes and reflectors being used to obtain polar curves giving very high candle-power values in certain directions, but wattage is equally subject to abuse, as can be particularly easily seen by comparison of any arc lamp lists. As a matter of fact, wattage is only a guide to the illuminating power of a lamp when the type and distribution curve of the latter are known. From the user's point of view, to specify by watts is no more instructive, or less liable to abuse, than specification by candle-power. A candle-power figure does bear directly on what the user wants, viz., light, but if candle-power is not stated, watts and efficiency (*i.e.*, watts per candle-power, which again brings us back to candle-power) are both required to tell the user what sort of a light-producing unit he is getting. Moreover, the user has to make a calculation to arrive at the candle-power value in the second case. It is a devious and quite illogical course to expect a user to get in the way of thinking of lamp sizes by watts. Perhaps a 40-watt lamp meets his needs now, but when a more efficient lamp is produced a 30-watt unit will suffice—the man has to keep on changing his purchasing unit.

The argument that a user purchases light by the candle-power is countered by the advocates of watt-rating saying they are prepared to mark lamps with candle-power as well as watts. This is a very insidious offer, and is not a solution to the problem, since it does not permit the user to get year after year lamps of the particular candle-power which meets his needs. Suppose that standard watt-ratings be adopted, as in Table I. Using lamps of 1·2-watt efficiency,

TABLE I.—Candle-Powers Available on Watt-Rating at Various Efficiencies.

Constant watt rating.	1·2 w. per c.p.	Candle-powers available. 1·0 w. per c.p.	0·8 w. per c.p.	0·5 w. per c.p.
10	8½	10	12½	20
15	12½	15	19	30
20	16½	20	25	40
30	25	30	37½	60
40	33½	40	50	80
60	50	60	75	120
80	67	80	100	160
100	83	100	125	200

a householder found that 30-watt lamps met his needs very well. Along came the 1-watt lamp, and the householder now gets 30 c.p. where he used to have 25 c.p. So far there is not much to grumble at (though if he had had the option he would doubtless have preferred to stick to 25 c.p. and get 15-20 per cent. off his lighting bill). Soon, however, the 0·8-watt/c.p. lamp will come along, and the householder has the option either of using 37½-c.p. lamps or of returning to the original 25-c.p. size (now taking only 20 watts).

Neither alternative is satisfactory. Continuously increasing the candle-power of an installation is not only unnecessary, but is, after a time, objectionable and harmful, and reference to fig. 1 will show that the gaps in the candle-

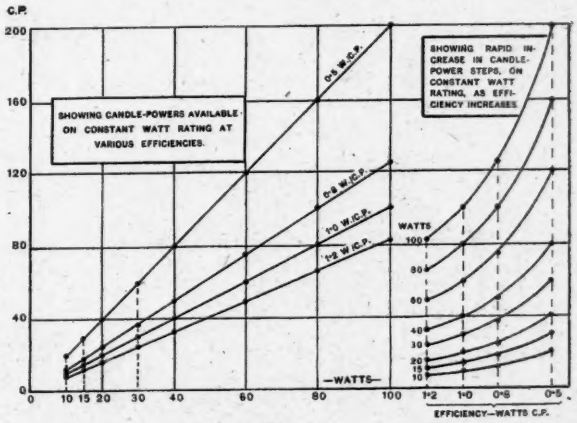

Fig. 1.

powers available become rapidly greater as efficiency rises, the watt series remaining constant. The fact that the consumer has to make fresh compromises with every increase in lamp efficiency—using a lamp either more or less powerful than the one he wants (except for accidental coincidences)—leads inevitably to a certain amount of dissatisfaction, whereas, on a constant c.p. system of rating, there would be nothing but satisfaction caused by the higher efficiency, every consumer getting the same light as before at less cost.

If this state of affairs is to be mitigated by introducing fresh values in the watt series as efficiency improves, why not do what will alone give the consumer full satisfaction—alter all the watt values to keep the standard candle-power values and increments, adding, of course, any higher or lower candle-powers made possible by improved construction or higher efficiency?

Table II shows that maintaining a constant range of candle-powers would necessitate finer wattage grading, as efficiencies increased. It is no doubt a manufacturing con-

venience to build to a fixed scale of watts, but it is totally illogical to sell any energy-converting device of variable efficiency on the basis of its power input. Who would dream, for instance, of sizing turbines or steam engines by the lb. of steam used per hour? Yet that would be a manufacturing convenience, for the design of turbine and engine starts from the flow of steam known to be necessary to produce the horse-power which the purchaser requires. Of course the steam consumption matters to the engine user just as the energy bill matters to the lamp user, but, in both cases, it is the output, the work-doing ability

TABLE II.—Watt-Grading Necessary for Fixed Candle-Powers at Various Efficiencies.

Constant candle-power rating.	1·2 w. per c.p.	Watts. 1·0 w. per c.p.	Consumed 0·8 w. per c.p.	0·5 w. per c.p.
8	9½	8	6½	4
16	19	16	13	8
32	38½	32	25½	16
64	77	64	51	32
100	120	100	80	50
10	12	10	8	5
15	18	15	12	7½
20	24	20	16	10
30	36	30	24	15
40	48	40	32	20
60	72	60	48	30
80	96	80	64	40
100	120	100	80	50

of the apparatus on which the latter must be sized. For another and closer analogy—does the manufacturer who had laid himself out to build quantities of $\frac{1}{10}$, $\frac{1}{16}$, $\frac{1}{8}$, and $\frac{1}{4}$-h.p motors change the rating of these to 0·012, 0·075, 0·15 and 0·3 h.p. when, by some means, he secures 20 per cent. increase in efficiency? Certainly not, he alters the proportions of the machines and beats rivals because his machines do a certain amount of work for 20 per cent. less energy consumption. Electric lighting is not a costly luxury. Everyone already uses just as much electric light as he needs, and what he wishes for the future is to get that light at lower and lower prices as time goes on, and not to have the amount of light manipulated and his energy bill the same till development happens to reach such a stage that he can use a lamp of lower wattage than before. It is only in dealing with such a commodity as light, which cannot be easily measured by the purchaser, that such a totally illogical practice would ever be tolerated for a moment. The thing to do is to keep on making half-pint and pint soup tablets, and not to expect the purchaser to drink stronger and stronger soup till suddenly he finds that what used to be a half-pint tablet will now make a pint of soup.

One of the chief advantages of electric lighting, viz., its constancy, is threatened by the constant-watts, variable-candle-power system of rating. It has been suggested that the greater constancy of watts, as compared with candle-power, is a cogent reason for rating by watts. Such an argument might apply to laboratory practice, but the user of electric light wants constant candle-power within, say, 10 per cent., and he gets it in modern lamps. The fact that the watts vary only 5 per cent. or so is of no interest to him; did they not vary at all that would not affect his primary interest in the candle-power.

The peculiar polar curve of many modern lamps and reflectors has been made an objection to rating by candle-power. The objection does not apply at all if lamps be rated, as they should be rated, in mean spherical candle-power. By so doing we preserve a logical basis of rating, and one on which the layman has quite reasonably accurate ideas. Mean spherical candle-power is a measure of total flux of light, and as such is a thoroughly suitable unit. It requires only a minimum of intelligence to see that the flux of light must be greater (*i.e.*, lamps of higher candle-power must be used), if the light is to be distributed from an indirect fitting, than if the same working illumination is required over a limited area which can be served by a concentrating reflector. Any difficulty which exists is certainly aggravated if lamps be sized by watts.

A 20-watt lamp may be insufficient for a medium-sized room, but amply sufficient for a motor-car headlight illuminating several hundred feet of road. The wattage gives no idea of illuminating value in the two cases, but candle-power rating does not require the type of lamp to be known. The mean spherical c.p. is the basis on which to rate the lamp for use in the room; for the headlight projector the total flux of light in the beam is again what matters, and is expressed proportionately by the mean spherical c.p. of the lamp. To meet the competition of acetylene and other headlamps it is particularly desirable that the direct c.p. of the beam should also be specified; it has a definite significance and use.

The specification and design of illumination schemes on a basis of watts per sq. foot of floor area is piling one absurdity on another. Already the use of half-watt lamps in indirect fittings has vitiated watt per sq. ft. tables compiled for ordinary tungsten lamps, and as time goes on, confusion will be worse confounded. Candle-power per sq. ft., on the other hand, is a true constant for each system of lighting and class of interior.

The difficulty is not to find arguments against watt-rating, but to find any reasonable argument supporting it. Since wattage is related to useful effect only by the efficiency factor of the lamp, and since the latter varies with voltage, a 40-watt lamp, say, is of distinctly different candle-power and lighting value according to the supply voltage—could anything be more confusing, absurd, and liable to cause dissatisfaction? Admittedly it is easier to check watts than candle-power, but one is no further forward unless the efficiency also can be verified, and this again introduces candle-power. Any checking by the purchaser is unnecessary in the case of standard makes of lamps, and surely a deliberate misstatement of candle-power and efficiency by a second-rate maker is within the cognisance of the law.

The argument generally used to give the *coup de grace* to the unbeliever in watt-rating is that this rating is used by most manufacturers, and has been justified by practice. The writer wishes flatly to contradict this statement. The watt-rating has been imposed on the public by consideration for the maker's convenience, and it has, so far, been tolerated because wattage rating is practically a candle-power rating on 1-watt per c.p. tungsten lamps. Directly higher efficiency is reached in lamps for household use, the watt-rating must either break down, or cause endless confusion and no little dissatisfaction if it be persisted in.

Undoubtedly lamps should be made now and always in a convenient range of mean spherical candle-powers. Marking with mean spherical candle-power and wattage will tell the ordinary user all he wishes to know. In addition, polar curves of candle-power should be available to any person competent to tell therefrom how lamps should be placed. This point and the lamp candle-power required have to be decided only when the lighting installation is first erected. At that time the user has expert or at least intelligent assistance. Thereafter, the maintenance of efficient and satisfactory results requires simply the periodical replacement of lamps by others of equal candle-power. Without such constancy of candle-power, which cannot be maintained under a watt-rating system, permanent satisfaction is impossible.

Both watts and mean spherical candle-power should be *marked* on lamps, but *candle-power should be the basis of sizing*. By all means let the manufacturer work if he likes on a watt basis in his factory, so long as he changes this basis when necessary to preserve acceptable candle-power values and increments.

Australian Railway Scheme.—The plans for the Sydney railway, authorised by Parliament, have been modified by the Government with the object of reducing the expenditure. The modification consists in raising the levels at terminal stations at Redfern and Circular Quay, which will be open-air stations, the four other stations being underground. The raising of the levels at the two points will reduce the cost of construction by £1,000,000. On account of the easier grades there will be a saving in power for working the railway, also with the present proposal 42 trains per hour can be run on each track, as against 36 in the original proposal.—*Sydney Morning Herald.*

THE PREVENTION OF ELECTROLYSIS IN BOILERS.

A great many cases of corrosion in boilers which have occurred both in marine and land practice, have caused extended investigation to be made from time to time as to causes of such corrosion, and the best means of security against deterioration due to such causes. Such investigations have been extended in many directions, and frequently the chemical and engineering treatment of the structural parts, and of the water used in the boilers, has proved of great benefit.

It has, however, become increasingly recognised that electrochemical action is responsible for very much of the deterioration which occurs in connection with such metallic structures as ships, boilers, condensers, pumps, and so on, with the result that for a long time past both private experimenters and public institutions have directed their attention to the problems underlying electrolytic corrosion.

In a recent report by the Corrosion Committee of the Institute of Metals, the abandonment of brass for condenser tubes was advocated. It was suggested at the same time that greater attention might be paid to electrolytic methods of combating corrosion. For many years auxiliary plates of iron, zinc or aluminium have been used with some effect in minimising corrosion by forming a galvanic couple with the metal to be protected, and this process is still largely used. When new, the action of such slabs is beneficial, because they are electro-positive to the metals they protect. Unfortunately, however, they are quickly transformed into zinc sulphates and iron hydrates, which substances are electro-negative. Obviously, therefore, when this occurs these substances join the attacking forces, and are doing more harm than good.

For this reason it may be of use to refer to an electrolytic process for the prevention of scale and corrosion developed by the Cumberland Engineering Co., of London, which has yielded interesting results. Mr. Cumberland's success can be attributed to the fact that a stronger force than the one which it is desired to eliminate is brought to bear permanently by the introduction of electricity from an external source, this being distributed in the following manner :— Anodes suitably insulated are fitted in the vessel to be protected and immersed in the water contained therein. A low-pressure current is then supplied which is regulated by suitable resistances fixed on a switchboard. The current is generally used at a pressure of from 6 to 10 volts, and by means of an ammeter fixed on the switchboard the operator is able by the aid of the resistance to adjust the amount of current supplied to any vesssel or parts of it. The iron anode is connected through an insulated bolt to the positive side of the circuit, and the vessel which it is desired to protect is connected to the negative side, making it the cathode.

When the current is supplied the elements of the water in the vessel become electrically charged, and by the laws of electrolysis the positive radicals or anions assemble at the anodes, and hence we find a film of hydrogen formed all over the immersed portion of the vessel, protecting it. The oxygen, acids and other destructive agents are attracted to the iron anode, which suffers from their attack, and, in course of time, becomes so reduced that it has to be renewed. By the use of this process the parts which used to suffer from deterioration through the corrosive effects of substances in the water are protected, the destructive action being transferred from the receptacle itself to the inserted anodes.

Moreover, in addition to preventing corrosion, this method removes all foreign matter from the immersed surfaces of the vessel. This is because the hydrogen is given off in minute bubbles on the surface of the metal, but underneath any scale, grease or other adherent matter. These bubbles mechanically loosen such deposits, and when the surfaces of the vessel are once clean the hydrogen given off prevents the settling of any solids. This cleaning effect will be seen to be most important, when one remembers that $\frac{1}{16}$th of an inch of hard scale may cause a drop in fuel efficiency of 10 per cent. in a furnace.

The cost of electricity and of anodes is extremely small when compared with the expense previously incurred for new tubes and for laying off plant for repairs; therefore it is not surprising that owners and engineers of large undertakings are showing great interest in what is to many an entirely new system. It is also worth noticing that most of the leading shipping companies have installations on the boilers and condensers of their vessels, while numerous progressive firms in Great Britain have also adopted this system for land practice. For example, Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, applied the process to eight of their boilers and an economiser, with the result that the corrosion inside the boilers, which was previously very active, and because of which the apparatus had been specially installed, entirely ceased to spread, while there has been a considerable improvement in the amount of deposit in the economiser; a great deal of the old scale in the boilers was shelled off, and there was less new deposit than before the adoption of this process. Many similar results could be quoted. Demonstrations of the working of the system can be seen at the company's head office, together with some interesting phenomena associated with it.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

This paper deals with the power (electricity and compressed air) supply given by the Rand Mines Power Supply Co., Ltd., to those gold-mining companies of the Central Mining-Rand Mines group which have contracted with the power company for the whole of their power requirements, and treats the subject from the consumers' point of view. The paper entitled "Power Supply on the Rand," * read by Mr. Hadley before the Institution on March 13th, 1913, dealt with the general power supply given on the Rand by the Victoria Falls and Transvaal Power Co., Ltd., and its associated company the Rand Mines Power Supply Co., Ltd., and treated the subject from the power company's point of view.

The companies of the group crush at present about 8,500,000 tons of ore per annum and produce about 36 per cent. of the total gold output of the Transvaal, or about 14.5 per cent. of the total gold output of the world.

The entire working and operation of the system of the Rand Mines Power Co. are under the technical control of the Victoria Falls Co.

Each of the mining companies in the Central Mining-Rand Mines group has its own separate contract with the Rand Mines Power Co., under which it "agrees to take from the power company all the motive power needed by it, in the form of electricity and/or compressed air."

The whole of the compressed-air supply (with the exceptions noted later) is given from the air mains of the Rand Mines Power Co., and only to the mines in the Central Mining-Rand Mines group. The Victoria Falls Co. has, so far, no air-compressing system.

An interim electrical supply, without any liability for damages for stoppages, etc., had been given to certain mines, up to about 8,000 k.v.a., from the stations of the Victoria Falls Co. The permanent supply under the terms of the contract began on March 1st, 1911.

The history of the first three years of the supply under the contract teaches one outstanding lesson, namely, that it is only courting failure to attempt to give a permanent and reliable supply without a proper reserve of generating and transforming plant. During 1911 and 1912 interruptions were frequent, both in the electrical and air supplies, and, as the fourth generator at Vereeniging was not put to work until October, 1913, a considerable amount of load (principally winders) was not changed over to electric drive until then, but was kept working on steam. It was not until August, 1914, that the power company was able to supply the whole of the compressed-air load, and up to that date a number of the old steam compressors on the mines were still used.

It is not for the author to explain the reasons for the frequent and sometimes lengthy breakdowns of the generating plant. He has little doubt, however, that some of them were caused by nothing else than continuous overloading, in an attempt to give as large a supply as possible from the existing plant, before the spare plant was ready. A reserve of 25 per cent. is not by any means too much, particularly with such large generating units as are used in the power company's stations, considering that the necessary periodical overhauls

* Abstracted in the Elec. Rev. March 28th, 1913.

must put a certain amount out of action almost all the time. Since the full amount (25 per cent.) of reserve plant has been available the supplies have been quite reliable, and any troubles have been generally local and of no long duration.

At the end of March, 1911, the power company was notified by the Rand Mines, Ltd., that its companies would require a total of 70,000 K.V.A. of electricity supply, and 21,000 lb. per minute of compressed-air supply at a gauge pressure of 100 lb., these demands being the aggregate of the demands of the individual mines as measured at the points of delivery.

Experience has shown that the maximum individual demands of the mines for electricity supply have a diversity factor of about 1.14, while the power factor averages about 0.77, so that the above aggregate demand represents a maximum demand upon the electrical system of about 47,300 KW. The load factor of the electrical system is about 75 per cent., and the annual consumption at the rate of about 310,000,000 units.

Considerable economies have been made in the use of compressed air since 1913, and the maximum aggregate air demands now vary in the neighbourhood of 18,000 lb. per minute. The diversity factor is also very variable, but averages about 1.13, so that the maximum demand upon the compressed-air system is about 15,800 lb. per minute, or 37,900 KW. The load factor is about 34 per cent., and, as an air unit represents 27.441 lb. at 100 lb. gauge pressure, the annual consumption is about 103,000,000 air units. The energy value of the air unit represents 0.641 of the energy in one electrical unit, assuming isothermal conditions of air compression.

A flat price is paid for the electric and air unit, and is subject to special rebates, depending on the working costs of the power company and the cost of railway carriage of coal.

Owing to the great expense which would have been incurred in carrying air mains to the outlying mines, it was agreed that four mines should obtain their compressed-air supply from their own electrically-driven compressors erected on the mines.

Mr. Hadley says in his paper that the electricity "supply is furnished to all mining consumers at 2,100 volts and 525 volts." Unfortunately the contract allows a variation of 10 per cent. up and down from the mean pressures, or a total range of 20 per cent. before any damages become due from the power company. That is, the higher pressure of supply can be anything between 2,310 volts and 1,890 volts, and the lower pressure anything between 577.5 volts and 472.5 volts. Such a range is much too great.

Damages are only payable for pressure variations beyond the above limits which last for more than ten consecutive minutes. If, however, the pressure variations cause a stoppage of any of the pumping, mining, and metallurgical operations, the damages due for failure to supply are payable.

The standard frequency of the electricity supply is 50 periods per second, but the contract allows a variation of 5 per cent. up and down from this, or a total range of 10 per cent., before any damages become due.

The whole of the transforming and extra-high-tension control apparatus at each point of supply on the mine properties is provided by the power company. The transformer and switch houses, however, are provided by the consumer. The transformer houses are brick or concrete structures, and including the switch-house section, cost about £450 per cubicle, to accommodate a 1,000 or 1,250 K.V.A. 3-phase transformer.

There are altogether 23 transformer houses at the various points of supply, and the ratings of the transformers installed (1914) aggregate 125,750 K.V.A. About 6,000 K.V.A. additional rating is to be added in 1915.

Metering the Supplies.—The arrangements for measuring the various supplies have been the subject of very careful consideration by both parties. The number of units of electricity supplied to the consumer is ascertained by three integrating watt-hour meters placed in series and connected in circuit at each point of delivery on the low-tension side of the transformers. One complete set of meters is installed for each pressure of supply.

The first meter of each set is the property of and kept in repair by the power company; the second is the property of and kept in repair by the consumer; and the third is the property and kept in repair at the joint expense of the consumer and the power company.

The consumer pays for the number of units represented by the mean of the readings of the three meters at each pressure of supply, together with an allowance for the actual losses in the transformers installed by the power company at each point of supply, which does not exceed 2 per cent.

If the reading of each meter is within 3 per cent. of the mean of the reading of the three meters, each meter is considered correct for the purposes of the accounts. If, however, the reading of any meter at any time shows a difference from the mean of more than 3 per cent., the accuracy coefficient of each of the meters is, as soon as possible, re-determined by a test, and each meter having a coefficient which shows an error of more than 3 per cent. is re-adjusted.

The power company's electric meter and the joint electric meter at present installed are both of the A.E.G. make, while the consumer's electric meter is of the General Electric Co.'s (U.S.A.) make.

The number of units of compressed air supplied to the consumer is ascertained by an air meter or meters provided by and maintained at the expense of the power company, and connected in the air-pipe line at the point of delivery. The consumer may also provide and maintain at its own expense an air meter or meters at the points of delivery.

The number of units of compressed air paid for by the consumer is the mean of the readings of the meters. If the reading of any air meter at any time shows a difference from the mean of the readings of all the meters of more than 3 per cent. such meter is, as soon as possible, tested and re-adjusted.

In addition to the tests referred to above, routine tests on all electric and air meters are made periodically by the technical staffs of both parties acting jointly.

The air meter used by the power company is of the Venturi type, while that used by the consumer is of the swinging-gate type. The former was described in Mr. Hadley's paper.

The gate type of air meter consists essentially of a weighted door or "gate," swinging from the top on horizontal pivots within a section of the main air pipe. The motion of the gate, the angular position of which is a measure of the flow of air, is transmitted through bevel gearing to a vertical spindle which is connected to the external counter mechanism. This is similar to that used for the Venturi meter, and is described in Mr. Hadley's paper. It contains automatic temperature and pressure correcting cams, and the indications of the dials are given direct in air units.

The "gate" meter has a much wider range than the Venturi meter, and will read with accuracy down to 2 per cent. of the full flow. The Venturi meter is not accurate below 10 per cent. of the full flow. Both the Venturi and the gate meters were designed by Mr. J. L. Hodgson, of Messrs. Geo. Kent, Ltd., and were first made for the Rand Mines Power Co., Ltd., and Rand Mines, Ltd.

Electric meters are tested *in situ* where necessary by means of portable secondary standard meters, which have previously been tested against the primary standard instruments of the power company in its laboratory.

Air meters are, where possible, tested *in situ* by means of portable secondary standard instruments, which have been previously tested against the primary standard instruments erected at Ferreira Deep, Ltd.

The large displacement air meter, belonging to Rand Mines, Ltd., which is used in the air-testing station at Ferreira Deep, Ltd., is described in Mr. Hadley's paper. It is in constant use, and has proved itself to be a most reliable, accurate, and effective apparatus.

All the electric meters at each point of supply are fixed in a special electric meter house adjoining the sub-station, and the connections to the various current and potential transformers are made through terminal panels, so that check meters and instruments can be readily inserted in the circuits.

The air meters at each point of supply, together with the main control valves and the temperature and pressure recorders, are fixed in the main air-pipe line within a special air-meter house.

The Use of Electrical Energy by the Mines.—The number of motors installed (1914) is about 1,500. They vary in size from 2 H.P. to 2,000 H.P. (R.M.S. rating), and the total horse-power is about 142,300, made up as follows:—

Winders	57,340 H.P.
Pumps	30,330 ,,
Stamp mills	13,890 ,,
Compressors	11,700 ,,
Tube mills	10,170 ,,
Hauling and conveying	5,290 ,,
Crushers	5,350 ,,
Workshops	2,110 ,,
Ventilating	1,370 ,,
Miscellaneous	4,750 ,,

Electric Winders.—The most important service is that of winding. There are at the present time 38 shafts in use on the mines of the group, many of which have underground winders for the lower depths, in addition to surface winders.

For the purpose of winding, shafts may be divided into three classes, viz. (*a*) incline shafts, which approximately follow the dip of the reef; (*b*) vertical shafts, which strike the reef at its lower depths; and (*c*) compound shafts, which descend vertically until the reef is struck and then follow on the incline.

A few of the compound shafts are still served by single-stage winders, the skip or cage first descending the vertical portion, then turning the corner, and finally descending the incline; but the majority now use a separate winder for the incline portion.

The deepest shaft of any mine in the group is No. 3 Shaft, Village Deep, Ltd., which is 4,144 ft. deep in the vertical. An incline shaft has already been sunk at the bottom of the vertical for a distance of about 1,200 ft., and will be continued for an additional 5,000 ft., which will make the total length of vertical and incline over 10,000 ft. The incline shaft is at an angle of about 35° to the horizontal, and will probably be served by two winders on different levels, in addition to the surface winder which deals with the vertical only.

When the general electrification scheme was decided upon, it was resolved, for financial reasons, to use as many of the existing steam winders as possible, by removing the connecting rods and connecting up the motors to the drum shafts, either directly or through gearing.

At the end of 1914 there were 69 electric winders in use or on order, as enumerated in the accompanying table. The figures do not include small winches, etc.

Out of the total number of winding motors now in use 51

of the 3-phase type and four of the Ward-Leonard type were ordered before the advent of the author on the Rand at the end of 1910. The policy which guided his predecessor in deciding to use 3-phase motors in such large numbers for winding was that of saving fresh capital outlay, as is indicated in a paper by Mr. H. J. S. Heather,* in which the theory of the control of such motors is investigated.

Mr. Heather thought the saving effected could not be under £50,000. Such a saving is certainly worth having, if there are no serious practical disadvantages from the operating point of view, and, generally speaking, it must be admitted that the three-phase winding motors on the Rand are working quite satisfactorily. Whether their use is justified, however, under all conditions, and whether Ward Leonard sets would not have proved more economical in working in many cases, are debatable points.

	New.		Converted.		
	Direct-coupled.	Geared.	Direct-coupled.	Geared.	Totals.
Ward Leonard ...	7	1	1	—	9
Three-phase ...	2	12	10	36	60

A 3-phase winding motor *per se* is a much simpler machine than a continuous-current winding motor, with its necessary adjunct on a 3-phase system of supply, the motor-generator, but its control is not nearly so simple.

The control apparatus consists essentially of :—

(*a*) Stator reversing switches, operated by the first motion in either direction of the driver's control lever.

(*b*) A variable rotor resistance, controlled by the further motion in either direction of the lever.

The rotor resistance usually comprises a tank in which are suspended metallic electrodes connected to the three slip-rings. One side of the tank is closed by a moving weir or shutter, so that the level of the electrolyte, which is circulated by a small centrifugal pump, can be raised or lowered at will, which varies the resistance across the slip-rings accordingly. The rate of rising of the electrolyte, and therefore the acceleration of the winder, are independent of the driver, being determined only by the rate of delivery of the pump, which is adjustable. This is much simpler than the complicated resistances, switches, and connections required by the Ward Leonard system. In practical operation, however, the Ward Leonard winder is much the easier to control, and for the following reasons :—

(*a*) The manual energy required to operate the control lever is much less. In the Ward Leonard system there is only a cylindrical or face-plate resistance switch to rotate, which has no appreciable weight or inertia to overcome.

In the ordinary 3-phase control there is the heavy weight of the weir to move up and down, and, although it may be balanced by external or internal weights, all the masses have to be put into motion and stopped by the driver every time. This is not only very tiring, but militates against accurate or fine adjustments of the position of the weir.

(*b*) In the Ward Leonard system the winding motor can be converted into a generator for braking, by bringing the control lever back just sufficient to lower the voltage of the generator (of the motor-generator set) below the back electromotive force of the motor.

In the 3-phase system the control lever has to be brought back beyond the neutral point, before braking (by reverse current) is obtained. That is (1) the weir and electrolyte have to be lowered, (2) the stator switches opened, (3) the stator switches closed again for the reverse direction, and (4) the weir and electrolyte raised.

(*c*) It is much easier to move the skip or cage of a Ward Leonard winder for a few inches (as is frequently necessary when coming to the landing place or tip) than to do the same with a 3-phase winder, for the reasons given in (*a*) and (*b*) above.

The above features are obvious to anyone who has ever handled both types of winders, and appeal strongly to the drivers.

Attempts have been made to relieve the driver of the manual labour required to operate the control lever of a 3-phase winder, by using electricity or compressed air for opening and closing the stator switches, and compressed air for raising and lowering the weir. So far as the stator switches are concerned, both agents are quite successful, although electricity is to be preferred from the author's experience, and is in common use on the Rand. For raising and lowering the weir, however, compressed air proved a failure, because it was found impossible to predetermine the exact position to which the weir would come, owing to the elasticity of the operating medium. Its trial showed conclusively that the driver must have direct mechanical control of the weir to work his winder properly.

There are other points which only affect the relative economy of working. In the Ward Leonard winder electrical braking requires no electrical energy from the line, and will easily return energy by running the motor-generator slightly over synchronous speed. This is a material saving, as electrical braking with a 3-phase winder can practically only be obtained by using either reverse current or an auxiliary braking machine, such as an eddy-current brake, both of which make a direct call for energy from the line.

The eddy-current brake, of which several made by the British Westinghouse Co. are in use on 3-phase winders at City Deep, Ltd., and Village Deep, Ltd., consists of a rotating field-magnet system, exactly similar to that of a low-speed alternator, fixed on the winder drum shaft, and revolving within a hollow cast-iron stator ring, with a smooth circular face opposite to the field pole-faces. Eddy currents are set up in the face of the ring when the magnet system is excited, which exert a very considerable and effective braking force without jerk or jar of any kind. Water is circulated through the hollow of the stator ring to carry off the heat which is generated. Fig. 1 shows the eddy-current brake on a winder at Village Deep, Ltd.

The energy for the magnet system is obtained from a motor-generator. As originally fixed it was intended that one motor-generator should serve the brakes on several winders, and, to this end, the regulating resistance was placed in the main circuit of the brake magnet-system. The final breaking of the field circuit at each operation proved very destructive to the switch contacts, besides setting up insulation strains, and the arrangement has recently been altered by employing a separate motor-generator for each brake, with a rheostat in the field of the generator, so that the main circuit is never broken. This has proved very effective.

Each eddy-current brake was guaranteed to lower a net unbalanced load of 7,200 lb. at a rope speed not exceeding 1,750 ft. per minute, which is half the normal running rope speed for the winders in question. In practice it has been found that the brake will do much more than this, as, with an unbalanced load of 9,000 lb., the rope speed can be brought down to 250 ft. per minute, with an expenditure of energy in the field magnet-system at the rate of about 45 KW. The application of the mechanical brakes will then stop the winder in a few seconds. To obtain an equivalent result by applying reverse current to the winding motor required an expenditure of energy at the rate of about 1,600 KW.

The obstacle to the more general use of the eddy-current brake for 3-phase winders is capital cost, which amounts (with the motor-generator, etc.) to nearly two-thirds of the cost of the winding motor, and, in the cases above mentioned, makes the cost of the equipment practically the same as for the Ward Leonard system.

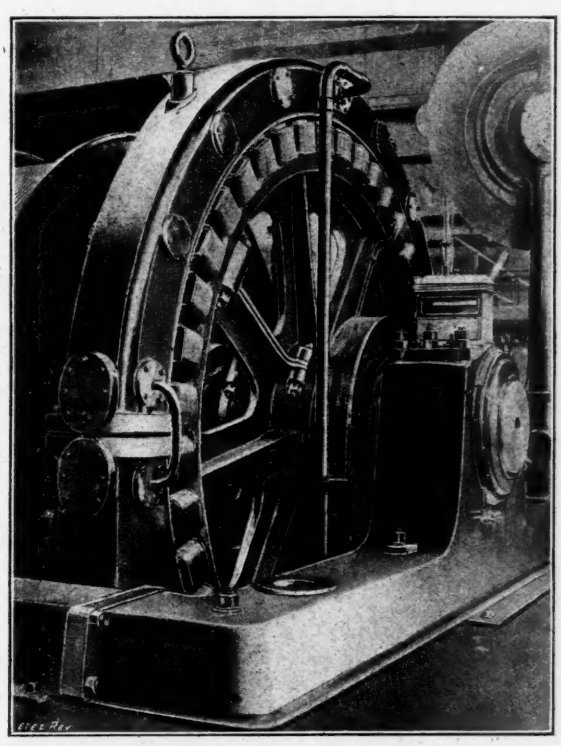

Fig. 1.—Eddy-current Brake at Village Deep, Ltd.

While general motor troubles are dealt with later, the two principal ones peculiar to 3-phase winding motors may be mentioned here. The first relates to the stiffness of the stator frame. A frame which may be quite strong and stiff enough for a motor running always in one direction, and only started and stopped say once per day or week, frequently is quite insufficient for a winding motor, which is not only started in opposite directions usually about once per minute, but has to stand the severe mechanical strains due to electrical braking just as frequently.

Some makers do not pay nearly enough attention to this point, and have supplied 3-phase winding motors of which the frames distort visibly when current is switched on to the stator, so much so that the radial air-gap has disappeared at certain points. In many cases the rotor core has had to be ground down, and radial stiffening arms made for the stator.

* Abstracted in the Elec. Rev. June 2nd, 1911.

Deep frames of box section, with heavy external or internal stiffening rings, are absolutely essential.

The second trouble relates to the rotor slip-rings and the control gear. If a 3-phase motor is running at full speed and reverse current at full pressure is applied to the stator, the induced open-circuit standstill rotor voltage is doubled. Many of the 3-phase winding motors on the Rand have an open-circuit standstill pressure of 750 volts, so that in such cases the application of reverse current at full speed, with the rotor on open circuit, would give a rotor pressure of 1,500 volts.

To avoid working with an open rotor circuit at any time, a sill is arranged at the bottom of the weir opening in the control tank, so that the tips of the electrodes are always immersed, but even with this a high rotor voltage is always obtained.

Manufacturers of 3-phase motors do not always provide sufficient insulation between the rotor slip-rings, between the slip-rings and the shaft, and between the brush holders, even for the full open-circuit standstill rotor voltage, if kept on for any length of time. The idea apparently is that, as the motors are run with the slip-rings short-circuited, the insulation is therefore of no great importance. Unless the insulation of those parts of such motors is kept scrupulously clean, trouble is often experienced in starting up.

With 3-phase winder motors this point is even more important, not only because such motors are started and reversed frequently for many hours together, but also because of the higher rotor voltage obtained when reverse current is applied.

The rotor resistance tanks which were originally supplied with the large majority of the 3-phase winders gave considerable trouble, because they were too small for the required duty and the electrodes were arranged much too closely together, a spacing of about ¾ inch between phases being common.

During straight winding operations no great difficulties were experienced, but flash-overs between the electrodes were frequent when reverse current was applied, and even when these did not occur the electrolyte soon reached too high a temperature, as the retarding losses were then added to the accelerating and winding losses. As soon as a flash-over takes place the automatic circuit-breaker opens and cuts the winding motor off the supply circuit, leaving only the mechanical brakes for stopping the winder.

The capacities of a number of the tanks were afterwards increased and the disposition of the electrodes altered. This has been quite effective in removing the risks of flashing over, but the resistance at full load is somewhat high, which not only wastes energy, but causes a comparatively high rotor "slip."

Some experiments were then made to determine the safe minimum distance apart between phases, so as to avoid any chance of flashing over. At ¾-in. spacing the flash-over voltage was 850-900 volts; at 2½ in. it was 1,620 volts.

It would be impracticable to arrange all the electrodes with no less distance than 3 inches between them, as the sizes of the electrodes and tanks would have to be very great in order to give a sufficiently low resistance at full load and speed, when the electrodes are fully immersed. As, however, the rotor voltage decreases to practically zero as the rotor attains full speed, and from twice the normal to less than normal as the winder and its load are gradually brought to rest by reverse current, it follows that the proper arrangement is to use electrodes of such varying shapes and lengths that the distances apart of those portions of the plates of the three phases actually within the electrolyte are gradually reduced as the electrolyte rises, and that the increase in the areas of the immersed portions of the plates is such that the current density is kept at a low value. A density not exceeding 1 ampere per square inch has been found to be a safe limit.

In other words, if the immersed portions of the electrodes are far enough apart and of such areas as will always keep the current density at a value not greater than the figure given, it will be found that they will be close together and of large area at full immersion when the rotor voltage is low and the current high; and at safe distance apart and of small area when the rotor voltage is high and the current low.

Various designs of flat-plate electrodes were tried with this object in view, but they all proved more or less impracticable. The experiment was then made of using a large number of rods (actually angle iron) of varying lengths, arranged in the tank so that their disposition could be easily changed to obtain the required result. This was successful, as no flashing over was observed under working conditions, and the increases and decreases of areas and resistances were quite satisfactory.

(To be continued.)

Discussion, in London.

Mr. Hadley said the paper described the largest installation, he thought, which purchased energy from a power company and gave some idea of the power contract. The power company had had to expend some 3½ million pounds to give this supply to the mines, and as regarded variations in periodicity and voltage, the plant was undoubtedly started at first without adequate reserve, but the position was now quite satisfactory. The power contract did not impose any particular obligation on the consumer as to use of the supply, as was often the case, and the power company also had considerable freedom. Big loads very often occurred suddenly, and he thought if the author had had his way, fewer direct driven winders would have been installed, and no doubt better results would have been secured.

Mr. Shepherd said he was struck with the enormous size of the undertaking, and asked whether 25 per cent. reserve plant was really sufficient with large turbine sets. It seemed to him that there was every advantage in putting in the Ward Leonard type of winder, but he was surprised that overwinding devices received so little mention, as the small headroom ought to make them useful. He asked whether the limiting head for centrifugal pumping had not been reached, and if it could be taken that practically no trouble had been experienced from insulation and dust in connection with the electrical plant.

Mr. C. P. Sparks said he gathered that the very large winders were all of the Ward Leonard type, and if that was so it coincided with the practice here. In moderate sizes the three-phase winder could be used efficiently, but for large sizes some other system should be used; he thought they would probably adopt metallic controllers with three-phase winders in view of the author's experience. In this country very large high-head centrifugal pumping plants had been used for some years. Ventilation underground seemed to be an entirely different problem on the Rand, and judging from the small power used it was possible that the efficiency of labour could be much improved by increasing it. In England pressure variation was confined to 2½ per cent. up or down, and this could very well be brought down to 1 per cent.

Mr. Hunter commented on the standardised size of H.T. oil switches; it appeared that mechanical methods in the mines were so settled that attempts at improvement were seldom successful. He asked whether the cam profile on the stamps had been altered in the author's experiments. The paper seemed to show that only the best apparatus should be used for large powers.

Mr. Roger Smith, referring to the question of measuring the purchased power, said the value of the accuracy given as 3 per cent. was some nine million KW.-hours, which was a large amount. When there were three meters in series, it was important that they should have different qualities of errors so that they cancelled out. He asked whether this was the case with the meter types used. Was there much difference between the results from meter calibration on site and in the laboratory, and what was the usual practice? The design of slip rings in induction motors was the weakest part and demanded the attention of manufacturers. His own experience was that it was worth while to use contactors for motors of smaller powers. He asked whether iron tube resistances, with water circulating in the tubes, had been tried.

Dr. Railing said he had discussed the technical features of the paper elsewhere, but as regarded the author's remarks on the relations between manufacturers and their customers, he agreed that no doubt the former had sinned in the past and not supplied exactly what the purchaser wanted. He thought, however, that during the past five years the position had quite changed, and that the manufacturer was now prepared to meet requirements.

Mr. Robert Hammond said the great feature of the centralised supply was that the advantages of diversity were obtained; this was not realised a few years back. The paper showed that in the case mentioned there were 142,300 H.P. of motors installed, and the maximum demand was only 47,000 KW. He had been confronted some years back with the suggestion that the winding peaks might synchronise, but there were 69 winders in use with a total of 57,000 H.P. in this group of mines.

Mr. Ll. B. Atkinson said the scheme of power supply in this case emanated from the consumer—the Rand mines group—but the originators did not succeed in convincing the mining people that the proposition was good enough for them to put their money into it. English engineers advised against the scheme in London, because it was thought that the proposals favoured the consumer too much, and consequently the money was found on the Continent. Another point was the possibly short life of the mines, which would have meant writing down the capital in, say, twenty years; but the mines would probably last longer than that. English people were prepared to finance the scheme, but English engineers said it was not good enough.

Mr. E. J. Fox said this explanation was quite different to that usually given of the matters referred to. He always understood that German financial methods enabled them to find money better than ourselves; the only money found by them was in the form of debentures, and they reserved to themselves the right to supply plant. He thought the City of London did find all the capital, but others got the plums.

Mr. J. H. Rider, in his reply, said that with good generating plant 25 per cent. spare was sufficient; the troubles referred to in the paper took place at a time when there was not 25 per cent. As regards trouble due to pressure variation, momentary fluctuations were not referred to, but times when the pressure was very high or low for many hours; the motors often took heavy currents for considerable periods and ran hot. Not until the Power Co. exceeded the limits mentioned could any redress be obtained. Now that the control system was improved the three-phase winder was perfectly safe; there was a little greater risk if the supply was cut off, but it could be counteracted if the mechanical brakes were in good order. No braking troubles had arisen with hoists which were constructed for electric working, but there had been

trouble with converted hoists. He had not much faith in overwinding devices; devices which took control out of the hands of the driver brought trouble. The risk of overwinding, he thought, was not serious, but there was a risk of starting in the wrong direction, and such cases were the more frequent. The high heads mentioned for centrifugal pumps probably did not represent the limit of the pumps, but were very near the limit of the pipe line. No particular trouble had arisen with insulation, but the Rand climate was very dry. The largest winders, of 4,000 H.P., were of the Ward Leonard type, but many of the three-phase winders had single motors of 1,500 H.P. capacity. It must not be imagined that there was a shortage of mine ventilation on the Rand, as an immense amount of air was discharged into the workings from the drills. The stamp mill was exceedingly simple and robust—and "efficiency," in its case, meant something that would not stop. As regarded the metering arrangements, each meter had its own transformers, and, speaking generally, there was no very great difference in the curves of the two types of meters. The metering was one of the most satisfactory features of the whole supply, and it was very seldom that any question arose with regard to it. The advantage of the contactor control was the easy work for the drivers.

MEASUREMENT OF WIRELESS SIGNALS.

A GENERAL meeting of the Wireless Society of London was held at the Institution of Electrical Engineers on April 20th, when Prof. E. W. MARCHANT delivered a lecture on Methods of Measurement of the Strength of Wireless Signals. Dr. Marchant said that the Duddell-Taylor formula had been found consistent with subsequent investigations, and Zenneck's theoretical results had been verified by Austin's researches, but though these and similar formulæ were useful in giving an idea of the order of magnitude of received currents to be expected, it was the considerable fluctuations in signal strength which had to be investigated, and this could only be done experimentally. Variations of the order of 2 : 1 were commonly observed at different times of day and under different weather conditions in the received strength of signals which were sent out by constant power. In seeking to make quantitative measurements on the strength of signals, the first essential was constant conditions in the receiving aerial, which should be of standard, easily reproducible form, and as free as possible from surrounding obstacles. The resistance of the aerial circuit and the earth connection should be constant. He had found a water-pipe earth very constant in resistance at 20 ohms. The ordinary central-station type of earth connection, a copper plate in moist coke, gave good results, and there was under construction at Liverpool an "earth" consisting of a copper strip and 6 sq. ft. plate laid in a sandstone trench. It was particularly interesting that this sandstone contained 10 per cent. moisture, though it had been covered by buildings and concrete for ten years past.

The most obvious method of measuring signal strength was by measuring the received aerial current or the voltage on the receiving circuit. About 1 microwatt was available on the Liverpool antenna (two 500-ft. horizontal wires 10 ft. apart, at a height of 150 ft.) from Paris, and these signals were very powerful. On the rectifying principle as little energy as 250 micro-microwatts could be made to give records. The Einthoven galvanometer would respond to 1 micro-microwatt, but it was a costly instrument, and some simpler and more generally accessible apparatus was desirable. The Duddell thermo-ammeter required about 1 microwatt. The Wolf heterostatic system gave good results; thread electrostatic instruments had not yet attained much success; hot wire barretters were too easily burnt out by a rush of current. A variable condenser in series with the aerial was extremely convenient, and to reduce trouble from atmospherics, weak coupling should be employed and an inductive leak arranged between aerial and earth; such a leak was very effective and did not interfere with normal working. The greater selectivity obtainable by indirect measurement seemed quite to outweigh the lower efficiency; disturbance by atmospherics and other signals was eliminated. Fleming's arrangement of an "artificial aerial," so that an inductance could be connected either to the aerial or to an inductance and capacity corresponding to the wave to be received, was very convenient.

As regards the type of detector to be used, the perikon crystal type (zincite-chalcopyrites) in conjunction with a sensitive galvanometer had been found best at Liverpool. This detector gave better and more constant results than any using softer crystals; unfortunately it and others followed a square law, and so were insensitive for very weak signals. The Fleming valve, having nothing to go wrong, and being unaffected by bad atmospherics, appeared very tempting for measurement work, but results at Liverpool had been disappointing. An auxiliary voltage was generally required in the detector circuit to bring the valve to the sensitive part of its characteristic. On trying to eliminate this by using a U-carbon filament and plate electrode only 1 mm. apart, it was found that the sensitivity of the valve changed considerably, but not definitely (*i.e.*, not so that the detector was either "right" or "wrong"). Several recent developments of the audion valve gave promising results. Magnetic detectors were hardly sensitive enough for measurements on very weak signals, and one would not expect electrolytic detectors to be very reliable for measurements. The present tendency was to use continuous waves for long wave-lengths, generally in conjunction with the heterodyne telephone or other beats receiver. A constant local current of high frequency was then required for measurement purposes. Heterodyne receivers were nothing like so efficient on spark as on continuous waves.

The Broca galvanometer used in the first quantitative work at Liverpool was satisfactory on good, sustained signals, and galvanometers were now available of sensitivity 240 mm. per micro-ampere, and period 0.1 second. The speaker's experience was that the best arrangement yet available was a high-frequency galvanometer in conjunction with a crystal detector. Members of the Society should take up the question of perfecting instruments and measuring signal strengths, since this, in conjunction with meteorological observations, would do more than anything else to increase our knowledge of the conditions affecting wireless transmission.

Mr. P. R. COURSEY said that, using Fleming's "artificial antenna" method, the chief difficulty was to measure the current in that circuit. Damping must be constant, and should be the same in the receiving and auxiliary circuit; Dr. Marchant's coupling method was preferable to direct connection. An alternating-current buzzer gave very steady oscillations, much better than obtainable working on its own contacts. It was possible to select Fleming valves which gave maximum sensitivity on zero auxiliary voltage. Rectification was much more perfect with a cylindrical than with a plate electrode. The tone wheel should be one of the best receivers for quantitative work with continuous waves. With it, an Einthoven galvanometer could be got swinging slowly so that half the amplitude of swing could be read at any moment; on moderately damped spark waves individual readings might be possible. When using a telephone in series with an Einthoven galvanometer, external noises often produced kicks and vitiated results.

Mr. W. DUDDELL said that he still hoped to be able to build an electrostatic R.M.S. voltmeter suitable for measuring aerial voltages. Using a tiny gold-leaf electroscope, it was possible to read signals under the microscope.

ELECTRICAL SUPPLY TRADE IN BRAZIL.

PERNAMBUCO will soon be one of the best fields for the sale of electrical supplies, as well as many other lines, in South America. It is the main port and capital of the great sugar producing State of the same name, and the Pernambuco Tramways and Power Co. has only recently inaugurated the first electric railway and lighting system the city has had.

An American Government report recently submitted points out that the city has under construction a modern power house of ferro-concrete which is being equipped with the latest design of machinery from the British Westinghouse Co. Three 1,000-KW. 50-cycle 6,000-volt turbo-generators have been installed, and the foundation for a fourth is being prepared. The boilers and boiler-room equipment were furnished by Babcock and Wilcox. The engine-room and switchboard equipment are British Westinghouse, and the wire and cables are also English. The street railway is 1 metre gauge. The company has 110 cars—70 single-truck cars from the Brill Car Co., and 40 double-truck cars from England.

The city is the first port touched by the large liners from the United States and Europe. It is served by five submarine cables, three to Europe, one to the north, and one to the south of Brazil. Telegraph lines connect the city with the most important towns of the State, and a wireless station affords communication with the station at Fernando de Noronha (an island belonging to Pernambuco which has a long-range station and is of great service to the large liners). Three railroads connect the city with the principal coast towns and the extreme western part of the State. Construction work in the docks has been stopped on account of the war, as most of the officials were French and have returned to France. A complete sewerage system is almost completed. The central sewage station contains three electrically-driven pumps, each of the capacity of 300 litres per second. The central and substations are supplied with power from two 250-KW. generators bought in France.

In October, 1914, the Pernambuco Tramways and Power Co. bought the telephone system from a Brazilian company. The system will have to be reconstructed from the switchboard to the subscriber. The present plant is on the earth-return system, with 800 telephones, mostly from Sweden, though a few are from England and France, a switchboard from Germany, iron poles from England, and wire from the United States. It will require a 1,200 drop board, 1,000 telephones, 2,000 iron poles, and 10 miles of cable and several tons of wire to reconstruct the system. The general manager of the Pernambuco Tramways and Power Co. will have charge of the rebuilding, and it would be advisable for companies intending to tender to communicate with him. It is to be hoped that firms tender-

ing will be careful to quote on just what the manager wishes rather than attempt to supply other goods, as has happened in the case of other cities.

The prospects for the sale of electrical machinery and supplies in Pará are not so good as they have been, but there is a steady demand for domestic specialities and a few motors. Most of the sales are being effected by the Pará Electric Railway and Lighting Co. (Ltd.), which is making a special effort to get as much apparatus installed as possible by selling at cost and allowing long credits. The company has had three public exhibitions, which have resulted in the sale of about £2,000 worth of household appliances, and the sales are running at about £300 per month.

Most of the household appliances sold and on hand are American made, and as they have been properly demonstrated the public appreciates their superiority, and buys them in preference to European goods which are selling at a lower price. As the lighting company is selling at cost it is not advisable for American manufacturers to sell to the local dealers.

The Pará Electric Railway and Lighting Co. (Ltd.), incorporated in England, with a board of English directors, and operated by J. G. White & Co. (Ltd.), of London, who are the engineers and purchasing agents, took over the street railway and lighting system in 1906 and has built up a modern installation. The company has material on the ground for the extension of its lines as soon as the financial conditions will permit.

The current for the lighting system is supplied at 2,200 volts through H.T. underground cables to feeder boxes, thence to the aerial lines, from which it is stepped down by single-phase, 50-cycle, oil-cooled transformers to 240 volts for power and to 120 volts for lighting. There are about 50 factories operated by electricity, with motors varying in size from 1 to 100 H.P.

The present price for current for lighting is 2s. 1d. per KW.-hour, and for domestic appliances 3d. per KW.-hour. Power prices range from 3d. up, according to the quantity consumed. The company has on hand sufficient material to last one year, with the exception of a few minor supplies which will be handled through J. G. White & Co., Ltd., of London.

Maceio is a small town on the coast, 180 miles north of Bahia. The population is estimated at 15,000. The power and lighting system is owned by J. Basto & Co., under the name of Empreza Luz Electrica de Maceio. The power plant consists of three Belliss & Morcom high-speed enclosed type engines, directly connected to 120-KW. 3-phase, 50-cycle, 2,200-volt generators, and two German oil engines connected to 240-KW., 600-volt direct-current generators. The generators, switchboard and instruments are from the Electrical Construction Co. The firm has been using English materials. It furnishes power, however, to the street railways, the manager of which is said to be favourably disposed towards American materials. The electric railway was started in June, 1914. There are 12 miles of single-track metre gauge, 10 single-track cars, 12 trailers, and 5 flat cars. All the equipment rails, poles and wires are from the United States, and are giving satisfaction. Street railway supplies will be considered by this company if presented by letter or catalogue, but the language used should be Portuguese or French.

The town of Bahia has a great future in the electrical trade. There are two railway systems, one owned by the city and the other by Guinle & Co., a Brazilian firm which owns the street railways in Petropolis and Nichtheroy. The city owns the lighting system, but would like to dispose of it if a fair offer could be obtained. Guinle & Co. also have under construction a hydro-electric installation 70 miles from the city calculated to furnish 30,000 H.P. in a dry season, but it will not be completed for at least two years.

There is a good opening here for firms that will enter this market with a full line of electrical and general machinery supplies, but there are one or two points that will have to be observed if much trade is secured. One is that reasonable credit should be allowed, with paper as security on which the banks of the United States would loan money. This is the method followed by the German firms which have made a success in this trade. Another is that an American firm doing business here should have a representative on the ground, who can exhibit and push the goods. "I called on a hardware dealer here who handles a small line of electrical fixtures from Europe," says an American Consul, "and when I tried to impress upon him the superior quality of American goods he agreed with me, but said the fixtures he handled were cheaper, the designs were more popular, and the goods were lighter in weight, an important item when the duty is considered. These considerations will be effective as long as there is no American representative of a fixture manufacturer here, but a live man could convince the people of the advisability of buying the best."

It is also important for the American firm to get in as close touch with the actual buying public as possible. The manager of the Singer sewing machine branch here said that if they did not have an organisation of branch stores throughout the city they would not sell one-fifth of the machines they do, as the people want to trade direct with the company and do not care to buy from an agent. The expense of entering this market properly, however, is more than most average American houses can afford, and it would be of value if a number of manufacturers could combine to push the export trade.

The sale of electrical machinery and supplies is being neglected in Bahia, because of the fact that Guinle & Co. are retiring from the market. This firm was organised by Mr. Guinle some years ago and has been of great service to the United States in placing American goods on the market. It was the agent of a large American company and had a head office in Rio and branches in Sao Paulo, Petropolis, Nictheroy, Bello Horizonte, Bahia, and several smaller places.

There are at present three firms carrying a small line of supplies, 85 per cent. of which are made in the United States. The only European house here has no stock at present. It is a branch of a Hamburg firm and was organised through the efforts of German manufacturers, who own the stock and control the company through the Hamburg office.

The firm handles the goods manufactured by the stockholders, and only German manufacturers are allowed to purchase stock. The local manager explained the system upon which the firm is working, and by which it has been able to secure most of the contracts for materials used in the small installations in the interior and many of the smaller supplies in the cities. The head office is in Rio, with branch stores in Sao Paulo, Santos, Rio Grande do Sul, Porto Alegre, Bello, Horizonte, and Bahia, and in each place the firm is in a position to handle complete installations of hydro-electric machinery, street railways, lighting systems, cotton mills, sawmills, and many smaller lines.

With this organisation, good banking facilities, and Government co-operation, the firm has been able to furnish about 75 per cent. of the materials used by the companies not controlled by American interests. It allows credit according to the amount of the order, and the interest ranges from 6 to 8 per cent. If the manufacturer does not want to carry the customer he can go to the bank and discount the bill, but the manager says that in most cases the bank is glad to get the paper without a discount.

A local hardware house handles a small line of fans, wire, lamps, fixtures and specialities which are American, with the exception of the lamps and fixtures, which are German. The latter are made of cheaper materials and the fixtures are more ornamental and of much lighter make. The manager says the fixture trade is a new line here, and the people have not had time to see the necessity of buying the best.

The United States has furnished over 40 per cent. of the electrical machinery and supplies used in Brazil, not through any concentrated effort, but because the street railway and light-power systems in various cities are under the management of Americans.

THE LUBRICATION OF BALL BEARINGS.*

By ARTHUR V. FARR.

The more general use of ball bearings on electric motors has brought up a number of questions on the proper means of lubricating them: "Should I use oil or grease in my ball bearings?" "What kind of lubricant should I use?" One user of ball-bearing motors stated his question as follows: "I have been offered two grades of grease for use on the ball bearings of my machine. To me these two greases look the same; yet one costs almost twice as much as the other. How can I tell a good grease?" The purpose of this article is to answer these questions.

It should be recognised at the outset that although ball bearings must always be lubricated, the lubricant in a ball bearing performs a function different from the one it performs in plain bearings. In plain bearings the lubricant is used to keep a film between the shaft and the bearing lining, and this film must be maintained constantly in order to prevent wear and heating. The purpose of a lubricant in a ball bearing, however, is merely to preserve the highly polished surfaces of the balls and races. The balls and races are always in point contact, which necessarily means metal-to-metal contact. As a general principle, it might be stated that any lubricant that will not cause rust or destroy the polished surfaces of the balls and races, and that will properly circulate through the bearing and lubricant chamber, will be satisfactory.

To preserve the highly polished surface of the steel balls and races, therefore, the lubricant must be chemically neutral; that is, it should be neither acid nor alkaline. A good way to determine whether a lubricant is either acid or alkaline is to place some of it on a highly polished steel surface for a time and then compare this surface with that of a similar sample which is still in its polished condition. If the finish has been at all attacked, the lubricant is not desirable. Use can also be made of litmus paper, which will change its colour to pink if the lubricant is acid and to blue if the lubricant is alkaline.

It is also necessary that the lubricant should not undergo any chemical change owing to heat or other causes. In order to guard against such a change, it is, therefore, usual to employ a clean mineral oil or mineral fat of best quality.

* From the *Electrical World*.

It is also essential that the lubricant should not contain any solid particles which would cause wear, and the lubricant chamber should be so sealed as to prevent the entrance of dirt, grit or other foreign substances into the bearing. It is quite a usual occurrence to find that a bearing wears down owing to solid particles of dust, etc., having found their way into the lubricant.

From the above statements it is evident that, in all cases where one need consider only the actual lubrication of the bearing, a clean, thin mineral oil can be used with advantage. The greater the speed, the thinner the oil.

On the other hand, in those cases where there is a possibility of risk of exposure to dust, moisture or acids, the ball bearing should be protected by means of a solid grease. To ensure proper protection, the whole housing around the bearing should be filled with this grease, which should be of such composition and consistency that the internal friction of the lubricant and the increase in temperature which may result from its use will not cause it to become fluid. For this reason pure mineral greases, such as vaseline, will often be found unsuitable, as they usually have a melting point of 86 deg. Fahr., and when melted are of about the same viscosity as water.

One should, therefore, in such cases select a solid grease of the very best quality—that is, it must have the lowest possible internal friction and, above all, be absolutely neutral so that there will be no risk of its attacking the polished surfaces of the bearing. Moreover, it should not contain resin or resin-forming matter. The presence of any large quantity of resin can be detected by the smell.

The solid grease suitable for ball bearings should contain about 90 per cent. of mineral fat.

When the temperature of the bearing can rise to 140 deg. Fahr. and higher, the bearing should be lubricated with a thick flowing machine or cylinder oil.

For vertical shafts where no special arrangement has been made for reliable lubrication with oil it is, of course, necessary to use grease, and what has been said with regard to the use of solid grease in general, of course, also applies to vertical mountings.

Many machine manufacturers who use ball bearings make a practice of attaching a card with instructions printed thereon for the care of the ball bearings on the machines. These instructions do not go into detail at all, but they contain an excellent outline of the solution of the lubrication problem, as follows:—

"To renew the lubricant in the bearing, remove the bearing cap, clean out all dry or caked grease, and wash out with gasoline or kerosene. Refill with a clean, fresh lubricant, being sure that the bearing and bearing housings are properly filled. Keep the lubricating and drain holes of the housing closed to prevent the leakage of lubricant or the entrance of dirt.

"Nothing but the purest mineral lubricant should be used, as any acid, grit, rust, etc., quickly ruins the highly polished surfaces of the balls and races, thereby materially shortening the life of the bearing."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BAHAMAS.—The Government of the Bahamas has recently passed an Act providing for a surtax of 10 per cent. to be levied on the amount of duty payable on all goods imported into the Islands. The Act, which came into force on March 8th last, is to remain in force for one year, and from thence to the end of the next session of the Legislature.

SPAIN.—The Spanish Government has decided to prohibit the exportation to foreign countries of the following goods: Scrap-iron, steel and other metals, aluminium, tin and crude rubber (natural or artificial), and similar materials.

RUSSIA.—The Board of Trade have received information from Russia to the effect that a Decree was published on April 11th by which the rates of the Russian General Customs Tariff for European Trade are increased by one hundred per cent. in respect of all German, Austro-Hungarian and Turkish goods, and on goods imported into Russia after passing in transit through Germany, Austria-Hungary or Turkey. Enemy goods which were free of duty under the Tariff are subjected to a special tariff, which is appended to the Decree. In virtue of the same Decree certificates of origin for foreign goods imported into Russia will be required from the date of the receipt of the text of the Decree by the various Russian Custom houses. A summary of the very detailed regulations contained in the Decree is being forwarded, and further information as to these will be given in due course.

CANADA.—Permission has now been given by the Postmaster-General of the United States for the use of Canadian Customs duty stamps on advertising matter for Canada, provided the stamps are affixed on the reverse side of the package. It will, therefore, now be possible to prepay the duty on catalogues sent to Canada by means of these stamps, whether they proceed direct to Canada or *via* the United States.

SWEDEN.—A Royal Decree dated March 12th revokes the Royal Decree dated October 20th, and provides a new list of articles the exportation of which is prohibited. Amongst the articles now prohibited are the following: Wire of copper and of alloys of copper with zinc, tin, or other non-precious metal, twisted into cords or cables not insulated; wire of copper and of alloys of copper with zinc, tin, or other non-precious metal, also electric cables or lines (a) furnished with sheath of lead or other metal with or without armouring, (b) insulated with rubber, gutta-percha, asbestos, or varnish, or in any other way.

SWITZERLAND.—Amongst the articles whose exportation has recently been prohibited are the following: Magnetos for automobiles, copper ore, lead ore, antimony ore, and other crude ore. The prohibition takes effect as from April 7th.

INDIAN NOTES.

[From our Special Correspondent.]

Kanchrapara Eastern Bengal State Railway.—A very up-to-date electric power house has recently been equipped at Kanchrapara, the chief loco and carriage workshops of this State railway. The scheme was designed and carried out under the supervision of Mr. A. E. Gundry, the electrical engineer to the line. Formerly the workshops were steam-driven, now the drive is entirely electric. For day working the generators are steam-driven, and for night loads, mostly for lighting purposes, the generator drive is by Diesel crude oil engine, manufactured by Messrs. Mirrlees, Bickerton & Day, Ltd. The entire electrical equipment was manufactured by the Lancashire Dynamo Co., and consists of generators, balancers, and motors for shop drive and various other purposes. A Rees Roturbo condenser and boiler feed-pump has also been provided. Some of the high-tension generating plant from the Sara Bridge power-house is to be removed to Kanchrapara to be used for long-distance transmission to Chitpore, for pumping purposes.

Railway Electrification.—Before the war it was confidently hoped that Government would sanction a scheme for electrification of the State Railway suburban lines from Sealdah to Barrackpore and Naihati; but in all probability this scheme will be hung up until more prosperous days.

Punjab Electrical Inspector.—It is reported that Mr. C. C. T. Eastgate, a well-known Calcutta electrical engineer, has recently been appointed to this post, and will shortly arrive in India from England to take up his new appointment.

Electrolytic Manufacture of Sodium.—The apparatus used to manufacture sodium industrially resembles the Castner cell; it has a conical base in which iron and other impurities collect, and a cylindrical cathode and narrow ring anode are placed close together, so that only 4½ to 5 volts are required per cell. According to a detailed paper on the subject by B. Neumann and S. Giertsen (abstracted in *La Revue Electrique*), it is best to employ a large number of small cells, each holding 155 lb. of molten soda and consuming 1,200 amperes. The caustic soda is melted in cast-iron pots and poured into the electrolytic cells when starting work, and from time to time during operation. The distance between the electrodes is regulated to maintain a suitable temperature, which is not generally measured. The cathode is not cooled artificially, and the whole question of temperature regulation seems to be left to the discretion and crude devices of the operators. The bell cover dips 2 or 3 in. into the bath, and sodium is collected only at long intervals. The molten soda is rarely anhydrous, hence considerable foaming occurs and hydrogen collects and burns beneath the cover; explosions are of frequent occurrence. According to the impurity of the caustic soda, the bath becomes black and frothy, and needs renewing every two or three weeks; if the soda contains silica, hard crusts form in the cover. From time to time the sodium formed is freed from soda, cast in iron moulds and stored in petrol or paraffin. The mean current efficiency in industrial working hardly reaches 40 per cent., and is more often only 30 per cent. On the basis of 40 per cent. current efficiency and 5 volts per cell, the energy consumption is 14·5 KW.-hours per kg., *i.e.*, 6·6 KW.-hours per lb.

Russian Patents.—A Decree, to which assent was given on March 6th, supplements the existing laws and regulations with regard to patents, with a view to enforcing certain restrictions on enemy subjects. Under the provisions of this Decree, patents for industrial inventions or improvements will not be granted to subjects of countries at war with Russia, and procedure in connection with such applications already received is suspended. Patents of concern to the national defences and belonging to enemy subjects become the property of the State without compensation.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,486. "Methods of and means for controlling alternating currents." British Thomson-Houston Co., Ltd. April 12th. (General Electric Co., United States.)

5,489. "Dynamo-electric machines." E. Rosenberg. April 12th.

5,511. "Insulators." Akt. Ges. Brown, Boveri et Cie. April 12th. (Convention date, April 25th, 1914, Germany.) (Complete.)

5,513. "Miners' electric safety lamps." O. Oldham. April 12th.

5,533. "Coin-freed apparatus for testing manual strength of pull and electric-circuit endurance." W. Keast. April 13th.

5,554. "Electrical measuring instruments." British Westinghouse Electric & Manufacturing Co., Ltd. April 13th. (Convention date, April 15th, 1914, United States.) (Complete.)

5,556. "Sparking-plugs and the like." J. A. Kennedy-McGregor. April 13th.

5,557. "Electric rectifiers and methods of operating the same." British Thomson-Houston Co., Ltd. April 13th. (General Electric Co., United States.)

5,584. "Electric switchboards, telephone-boards and the like." H. B. Prentice & H. Atlay. April 13th.

5,591. "System for the generation of electric currents." C. F. Benitez. April 14th. (Addition to 17,811/14.) (Complete.)

5,594. "Field telephone or telegraph wire reel." G. Dod. April 14th.

5,596. "Electrical relays." J. Savin & Automatic Telephone Manufacturing Co., Ltd. April 14th.

5,602. "Electric signal systems and apparatus for use in mines and the like." G. Deakle and J. Davis & Son (Derby), Ltd. April 14th.

5,623. "Electric alarm systems." Siemens & Halske Akt. Ges. April 14th. (Convention date, April 16th, 1914, Germany.) (Complete.)

5,627. "Brazing material." British Thomson-Houston Co., Ltd. April 14th. (General Electric Co., United States.)

5,628. "Electric lamp lock." W. G. Rudd. April 14th.

5,629. "Telegraphy." B. L. Bobroff & Universal Indicator Co. April 14th. (Complete.)

5,630. "Mounting of electric oscillators for submarine signalling." W. J. Meilersh-Jackson. April 14th. (Submarine Signal Co., United States.)

5,639. "Electrodes for arc lamps." F. M. Lewis. April 14th.

5,657. "Trolley-setting guide for use on tramways." J. A. Walshaw. April 15th.

5,664. "Metal trays or supports for carrying electric wires." J. H. Collin. April 15th.

5,672. "Brushes or connections for magneto-electric machines." C. C. W. Simpson. April 15th. (Divided application on 19,784/14. September 15th.)

5,673. "Contact-breakers for magneto-electric machines." C. C. W. Simpson. (Divided application on 19,784/14. September 15th.) April 15th.

5,676. "Alternating-current voltmeters." H. S. Dransfield. April 15th.

5,684. "Electric-discharge controlling devices and methods of operating same." British Thomson-Houston Co., Ltd. April 15th. (General Electric Co., United States.)

5,696. "Automatic switching apparatus for electrically-illuminated signs and the like." E. Savoye. April 15th. (Addition to 823/15. Convention date, April 30th, 1914, France.) (Complete.)

5,697. "Apparatus for recording phonetic sounds transmitted by means of a telephone." A. E. Lamkin. April 15th.

5,708. "Electro-magnetic solenoids." L. B. Farmiloe. April 16th.

5,717. "Electric switches." J. H. Tucker & J. A. Crabtree. April 16th. (Divided application on 21,175/14. October 19th.)

5,723. "Magneto-electric machines." P. A. Bentley. April 16th.

5,725. "Electrical apparatus for therapeutic and like purposes." G. Vernon-Ward. April 16th.

5,726. "Electrical apparatus for therapeutic and like purposes." G. Vernon-Ward. April 16th.

5,727. "Means for attaching electric cables or conduits to switches and the like." G. Ellison & J. Anderson. April 16th.

5,731. "Portable primary batteries or cells." C. H. Elliott. April 16th.

5,741. "Electrical discharge devices and methods of operating the same." British Thomson-Houston Co., Ltd. April 16th. (General Electric Co., United States.)

5,753. "Method and means of constructing electrical measuring instruments." M. J. E. Tilney & N. C. F. Jensen. April 17th.

5,768. "Electric lighting." I. Frankenburg & Sons, Ltd., and E. Fleming. April 17th.

5,783. "Aerial conductors for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. April 17th.

5,784. "Means for indicating and correcting small changes in the speed of a machine." Marconi's Wireless Telegraph Co., Ltd., & C. S. Franklin. April 17th.

5,794. "Electric arc forming device for use in electric valves or rectifiers or in oscillation generators." Edison & Swan United Electric Light Co., Ltd., and S. R. Mullard. April 17th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

28,183. Method of Determining the Location of Radio-telegraphic Lighthouses or the like. A. Blondel. December 6th. (December 7th, 1912.)

29,751. Electric Incandescent Lamps. V. Terry & E. Terry. December 24th.

1914.

624. Protective Devices for Dynamo-electric Motors. G. Ellison and M. R. H. Mueller. January 9th.

4,941. Electric Heaters. J. R. Quain. February 25th.

6,389. Arrangements for sending Time or other Signals by Telegraphy or Radio-telegraphy. E. Belin. March 13th.

6,430. Dynamo-electric Machines for Starting and Lighting Motor-cars and the like. A. H. Midgley & C. A. Vandervell. March 13th.

8,173. Protection of Alternating-current Electric Generators. British Thomson-Houston Co., F. H. Gough, & J. Whitcher. March 31st.

8,717. Electric Regulating Devices. British Thomson-Houston Co., D. E. Jewitt. April 6th.

9,134. Electrically-controlled Block Systems for Railways. J. Sayers, W. C. Acfield, G. Salt, & B. W. Cooke. April 11th.

10,823. Electro-magnetic Apparatus for Controlling Electric Circuits. C. P. Wells. May 2nd. (July 9th, 1913.)

12,721. Electrical Signalling Apparatus. W. A. Heyes & L. O. Heyes. May 23rd.

13,524. Automatic Switching Mechanisms, more particularly for use in connection with Telephone Systems. Western Electric Co. (F. T. Woodward acting for Western Electric Co.). June 3rd.

17,326. Electric Incandescent Lamps. I. Langmuir. (September 4th, 1913.) July 21st.

Ultra-Violet Rays from the Oscillating Spark.—The quartz enclosed mercury vapour arc, which first rendered practicable the application of ultra-violet rays to such services as the sterilisation of water, has now a rival in the oscillating spark which, according to Prof. J. Kowalski, of Fribourg, forms under certain conditions a more economical source of ultra-violet rays. Working on an industrial scale with a step-up transformer feeding the oscillating circuit (which comprises a battery of condensers, self-induction and spark-gap paralleled across the condensers and discharging the oscillating circuit at intervals), it is claimed that water sterilisation requires no more than 45 to 90 watt-hours per 1,000 gallons treated. Laboratory tests show from 200 to 400 watt-hours per 1,000 gallons to be necessary for complete sterilisation, but water treated in practice is less infected than laboratory samples, and conditions generally are more favourable to rapid sterilisation. The wave-length of maximum radiation from the oscillating spark is displaced towards the ultra-violet as the amplitude of the oscillating current is increased and as the spark is more strongly damped (*i.e.*, as the energy expenditure in the spark increases). In order to increase the amplitude of the current, the capacity of the oscillating circuit must be as great and the inductance as small as possible. There is a risk, however, of increasing inductance as well, if it be sought to provide large capacity by using a great number of condensers. There is a certain value of $\sqrt{C}L$ (corresponding to the wave-length of current produced in the oscillating circuit) which should not be exceeded for best radiation efficiency. The material of the electrodes is an important factor and should be such as to give maximum damping. Ultra-violet radiation between electrodes of invar, aluminium, brass, zinc and copper is found to be proportional to the numbers 128, 99, 85, 78 and 73. The frequency of sparking is also important, the ultra-violet intensity from a 22-mm. gap between invar electrodes being proportional to 2, 1·6, 1·3 and 1·0 with 20, 30, 40 and 50 sparks per second respectively.

The percentage distribution of radiation horizontally in the direction of the axis of a 110-volt Heraeus lamp, operating at 90 volts, 3·1 amperes, is given thus:—Heat, 24 per cent.; visible, 41 per cent.; ultra-violet, 35 per cent.; wave-length, 436-334, 24·7 per cent.; 334-275, 13 per cent.; 275-233, 11·3 per cent.; 233-223, 11 per cent. The radiation from a 22-mm. invar gap, operated at 30 sparks per second, with 50·5 amperes in the oscillating circuit, is analysed, by the same method, as follows:—Heat, 22 per cent.; visible, 18·6 per cent.; ultra-violet, 59·4 per cent. These figures show the oscillating spark to be 70 per cent. richer than the mercury arc in ultra-violet radiations. The spark gains a considerable initial advantage in that it can be produced directly in the water to be treated, without the necessity for the quartz envelope which absorbs up to 20 per cent. of the ultra-violet radiations from a high-pressure mercury arc, and those, moreover, which have the greatest sterilising value. To meet industrial requirements for a simple instrument determining the ultra-violet radiations of any source, Prof. Kowalski utilises the property possessed by ultra-violet rays of decomposing lævulose (and certain other carbohydrates) to liberate carbonic oxide. The beam to be tested is simply passed through the windows of a small closed vessel containing lævulose and connected to a mercury-filled capillary tube which indicates the amount of gas liberated, and so, subject to a temperature correction, the intensity of the ultra-violet radiations.—*La Revue Electrique.*

Russian Views on Municipalisation.—At a recent meeting (March 18th) of the Imperial Russian Technical Society, held to consider the proposed purchase of the electrical concerns of Petrograd by the town, to which reference was made at a previous meeting, the majority of those who took part in the discussion spoke emphatically in favour of the municipalisation of the Electrical Trust. Some, however, felt compelled to point out that such concerns as tramways and telephones, run by towns, often proved to be unsatisfactory; some involved loss, as in the case of gas supply; and, generally, they did not efficiently attain their object of serving the interests of the consumers; whereas gasworks in private hands yielded good profits. One of the speakers specifically instanced towns where the electricity was already municipalised—Karkoff and Samara—where the position was very unsatisfactory. Experts, representatives of electrical companies, contested the assertions of the lecturer, K. Ya. Zagorsky, that with the adoption of turbo-generators of great power, production would be cheaper. The experience of one company had, they said, demonstrated the inaccuracy of that opinion. Another speaker, analysing the figures on which Prof. Wolf concluded that the price of energy could be much reduced, said it was impossible. The town would gain nothing, and the concern would yield too little profit. It were better to try to reduce the rates of existing companies. The discussion became heated, and lasted till midnight, when the meeting stood adjourned.